

The Nature of Us
A Curriculum that Draws Parallels Between Horticulture and Wellbeing

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Abstract

As the global population increases and advances technologically, humans move away from rural living and towards urbanization, resulting in the decline in the amount of green space and connection to nature. American teenagers are faced with surmounting pressure to perform academically in an education system that focuses on a narrow selection of subjects at the expense of their physical, mental, and social health. A growing field of research explores the effects of nature-based interventions on these effects that are defined as Nature-Deficit Disorder. The purpose of the present curriculum is to create links between horticultural topics and biopsychosocial (BPS) concepts for 15-16-year old teens that are preparing to enter the workforce. A panel of four professionals evaluated the curriculum units using a 5-point Likert scale and open-ended questions to provide feedback for improving the lessons. Although the panel concurred that the abstract components relating to the BPS concepts were clear and tangible, the respondents felt that the methodologies and practicality of instruction and assessment required improvement. Despite a range of responses relating to the evaluation questions likely due, in part, to the varied professions and backgrounds of the panel members, feedback confirmed that *The Nature of Us* curriculum clearly connected the horticultural and BPS principles and could easily be integrated into existing programs.

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CHAPTER ONE

INTRODUCTION

Background

Since 1900, life expectancy has more than doubled (Demaio, 2018). Subsequently, the global population is steadily rising and is expected to increase by 26% by 2050. Some of the fastest growing populations are in the poorest countries, which places significant constraints on the eradication of poverty, inequality, hunger and malnutrition, and on the development of quality of health and education organizations. It has been proposed that nine countries, including the US, will constitute more than 50% of the expected population growth over the next 30 years (United Nations, Department of Economic and Social Affairs, Population Division, 2019a).

According to the United Nations, Department of Economic and Social Affairs, Population Division (2019b), 55% of the world's population lives in urban areas. The percentage of urban dwellers is expected to rise to 68% by 2050 (United Nations, Department of Economic and Social Affairs, Population Division, 2019b). In the United States, more than 80% of the population inhabits urban spaces (United States Census, 2016). Urban areas are defined as densely settled areas with more than 50,000 residents (United States Department of Agriculture, 2018). This increase in urban population is due to an increase in overall population and shift away from living in rural areas (United Nations, Department of Economic and Social Affairs, Population Division, 2019b).

Food security is a critical issue that is compounded by an increasing global population. The space used for food production accounts for a total of 37% of terrestrial land area, with 26% required for animal pastures and 11% for crops (European Space Agency, 2017). Without technological and agricultural innovations to decrease the necessary acreage for food production, the 2030 global population will require 50% of the earth's land area for agriculture. Thus, an

inverse relationship develops between the amount of land dedicated to agriculture versus housing and businesses. Urban areas will experience the majority of the pressure from population growth and may potentially spread over remaining fertile land, which is typically reserved for cities, leaving poor quality land for agriculture. This is a concern because, “increased agricultural intensity due to population growth may increase land degradation over time. This could trigger a positive feedback loop where increased degradation leads to more degradation through intensification” (Schneider et al., 2011, p. 205). Additionally, food security rates are lower in urban areas than their suburban counterparts. Twenty percent of the US urban population and greater than 30% of the residents of Chesterfield County, Virginia have low access to grocery stores (United States Department of Agriculture, 2018). As global populations and urbanization continue to increase, one must recognize the finite nature of green spaces such as agricultural space, woodlands, parks, gardens, and yards.

Statement of the Problem

As our growing population continues to advance technologically, there appears to be a parallel between the shift from rural to urban living and from active to sedentary recreational values in the United States. A connection to nature and concern for the environment is best learned as a child and sustained into adulthood but Americans are increasingly choosing electronic entertainment, such as video games, computers, cell phones, and social media, over outdoor activities as determined by Pergams and Zaradic (2006). The nonclinical term “nature-deficit disorder” (NDD) was introduced by Richard Louv to describe the effects of diminishing green spaces, increasing use of electronic entertainment, urbanization, and increased pressures from school and work on young people (Warber et al., 2015). The World Conservation Congress (2012) recognized concern for NDD and the amount and quality of exposure to nature

experienced by children. The organization also declared that having access to nature and a healthy living environment should be a human right (World Conservation Congress, 2012).

Between 1997 and 2003, the number of American children who spent time outdoors dropped by 50% (Kimbell et al., 2009). A survey was released in support of Playday (2010), a collaborative effort to provide outside play for youth in the United Kingdom, that allowed children and adults to voice their opinions regarding generational changes in outside play. Half of the parents surveyed did not feel comfortable allowing their children to play outside without adult supervision, even if other children are playing outside. This is likely due, in part, to the fact that 15% of parents reported distrust in their neighbors and 71% of children reported concern for being kidnapped. Tragically, 44% of men and 28% of women stated that they would not approach a child in need because they did not want other adults to think they were attempting to abduct the child. An understandable result of this distrust is that almost 80% of adults reported a weakening community spirit. Despite these results, the overwhelming majority of surveyed adults believe that the presence of children playing outside facilitates community cohesion and trust and nearly 75% of children expressed a desire to spend more time outside (Playday, 2010).

Similar results were found in a 2015 survey distributed to parents in Australia. Forty-eight percent of parents were concerned about their child being abducted while unsupervised and 36% of respondents completely avoided situations in which their child would be unsupervised. Overall, parents were more concerned that their child would be abducted than for their child's general safety (Crawford et al., 2015). The U.S. media has been criticized for sensationalizing child abduction and "stranger danger" by exaggerating the proportion of abductions by a non-family member (Miller, 2014; Moscowitz & Duvall, 2011; Taylor et al., 2011; Vukovic, n.d.). This is in spite of two important facts: roughly 90% of missing children are runaways, are lost, or

simply failed to communicate their plans (National Center for Missing & Exploited Children, 2018), and the rates of child abduction in which a child's disappearance was reported to police decreased by more than 50% between 1999 and 2013 (Sedlak et al., 2017).

To further compound the problem, American students are increasingly pressured to succeed in school. Education reform in the U.S. stresses student success in mathematics and reading as determined by standardized testing and high school graduation rates (Paul, 2016; The Every Student Succeeds Act: Explained [TESSA], 2015). These pressures are causing teenagers to experience extreme stress levels rivaling that of adults (Bethune, 2014). Research has shown that teenage suicide rates increase significantly during the academic school year and drop during the summer months (Hansen & Lang, 2011; Plemmons et al., 2018).

Rather than playing outside after school and homework to alleviate their stress, today's youth are spending nearly eight hours every day using electronic devices (Coyle, 2017). Not only is this detrimental to physical health, but psychological and emotional health and creativity are at risk due to a lack of the spiritual and emotional connection to nature (Kimbrell et al., 2009). Warber et al. (2015) designed a mixed methods study to measure the effects of participation in a wilderness camp on 18 to 31-year olds. The researchers were interested in the specific effects on nature-related outcomes (perceived safety, leadership, and connection to nature) and wellbeing outcomes (perceived stress, relaxation, and sense of wholeness), both of which increased significantly after participation (Warber et al., 2015). It has also been suggested that attention deficit and hyperactivity disorders may even be alleviated by time spent outdoors (Kimbrell et al., 2009). Education professionals are working towards the induction of curricula that incorporate an all-inclusive approach to education, development, and health (Cannizzo, 2010a; Cannizzo, 2010b; Ito, 2010; Jiler, 2009; Lieber & Tissiere, 2017; Swank & Swank, 2013).

Purpose Statement

The present curriculum is designed to teach vocational, social-emotional and behavioral skills, while incorporating the multitude of benefits associated with the interaction with nature. The curriculum attempts to satisfy the current educational absence in a place and time where humans are preoccupied with concrete, electronics, and prescribed education. By incorporating education and industry-based standards, expert guidance, and elements from horticulture therapy, this curriculum will teach horticultural skills that will prepare students for an agricultural career while creating meaningful connections to self-care and wellbeing. It is the author's hopes that this curriculum will serve as a model for educators, counselors, and program directors seeking a course that integrates horticulture and a holistic approach to wellbeing.

Definition of Terms

Social and emotional learning: The process by which individuals develop skills in self and social awareness, self-management, relationships, and responsible decision-making (CASEL, n.d.)

Green space: Any land that is partially or wholly covered in vegetation and is accessible to the public (EPA, n.d.)

Biopsychosocial model: The interaction of biological, psychological, and social factors on health and health care (Engel, n.d.)

CHAPTER TWO

LITERATURE REVIEW

Federal Education Mandates

As mentioned previously, an increasing population creates challenges in providing quality education to all. Since the mid-1960s, education in the United States has been focused on accountability and emphasized high standards. In 1965, the Elementary and Secondary Education Act (ESEA) was signed into law by President Lyndon B. Johnson. The ESEA was developed as an attempt to close the gap between the middle and lower classes in reading and mathematics. One provision, Title I, of the ESEA was a program that allocated federal funding to schools with students from low-income families. A series of other provisions were developed and amended over the years to protect minorities, immigrants, and females (Paul, 2016). In 2002, President George W. Bush signed the No Child Left Behind (NCLB) Act as an amendment to the ESEA of 1965. NCLB required states to develop and enforce stricter standards in reading and math, as an attempt to hold schools accountable for students' academic progress and success (Linn et al., 2002). Schools that did not meet the adequate yearly progress (AYP) requirements set forth by NCLB for several consecutive years were at risk for losing Title I funds (Lynch, 2016). Despite being developed with the best intentions, NCLB had several negative impacts on education in the United States. The role of the federal government in education increased significantly, due to its involvement in the approval of testing programs and development of AYP accountability programs. The number of tests students were required to take also increased substantially (Jennings & Rentner, 2006). Additionally, the program prioritized the importance of scores over student growth and overall progress, and the punishment of schools who do not meet the AYP rather than rewarding success (Paul, 2016). The threat of losing Title I funds also encouraged schools to lower their standards. Some schools adopted certain testing procedures

that skewed results in favor of the AYP (Jennings et al., 2002). Lastly, this threat intimidated schools to focus on reading and math, which were the core subjects of NCLB, at the expense of other subjects (Jennings & Rentner, 2006). President Obama signed the Every Student Succeeds Act (ESSA) in 2015, which relaxed some of the severe restrictions placed on states by NCLB and decreased the involvement of the U.S. Department of Education in state accountability. Although ESSA includes graduation rates as a novel, yet required goal, reading and math continue to be the only subjects of importance (TESSA, 2015).

National Education Standards

National education standards that dictate the subjects of importance to K-12 students in the U.S. include fine arts, language arts, math, physical education and health, science, social sciences, and technology. Due to the emphasis on standardized goals and scores, teachers must squeeze in behavioral and social skills whenever applicable to the core curriculum. National education standards outline an attempt to connect the core curriculum to behavioral skills. This is apparent in the individual standards and goals outlined by Education World (n.d.). For example, the national physical health goal NPH.K-12.5 defines the goal of responsible behavior as the ability to demonstrate “responsible personal and social behavior in physical activity settings.” This is echoed in standards for each subject. However, standards for all subjects other than language arts and math are considered voluntary on the state level, and behavioral skills are not included in standardized assessments (Education World, n.d.). By solely emphasizing reading and arithmetic, the federal government neglects the social, emotional, and behavioral development of American youth.

Independent Social-Emotional and Behavioral Programs

Independent organizations have developed evidence-based programs for youth and adolescents that focus on changing the thoughts and behaviors of participants toward positivity and resilience. These programs are directed toward a variety of target populations and contexts. Programs like ACCEPTS (A Curriculum for Children's Effective Peer and Teacher Skills), PATHS (Promoting Alternative Thinking Strategies) and Connecting with Others promote socialization, effective communication and coping skills in children through directed group and individual activities (O'Connor et al., 2014). Dr. Arnold Goldstein's (1999) Prepare Curriculum is designed for middle and high school students and incorporates activities like games, reflection and discussion to reduce stress, aggression and prejudice. Dr Goldstein also collaborated on the EQUIP program described by Gibbs et al. (1999), which is directed toward at-risk and delinquent youth. EQUIP is a two-part program in which participants are taught anger management, morality and prosocial skills and then practice these skills with each other. Similarly, the global nonprofit organization Committee for Children has developed a series of curricula under the Second Step program aimed at protecting children and adolescents from violence, substance abuse, and other delinquent behavior by fostering the development of prosocial skills and positive relationships with adults (O'Connor et al., 2014). Super Skills is a program aimed at youth with autism spectrum disorders and is designed to promote fundamental skills, such as eye contact and appropriate facial expression, social initiation skills, social response skills and the development of positive relationships (Coucouvanis, 2005). Independent organizations such as these offer curricular models that emphasize the development of life skills for special populations.

Green Space

Exposure to green spaces has been studied by a number of researchers in several capacities relating to health and socialization. Individuals who are exposed to green spaces experience “increased connectedness to nature, attentional capacity, positive emotions, and [the] ability to reflect on a life problem” (Mayer et al., 2008, abstract). MacKerron and Mourato (2013) found that individuals were significantly happier while in a green space compared to an urban environment. Similarly, the research of White et al. (2013) suggest that individuals living in urban areas with green space have lower mental distress and a higher level of wellbeing than those living in urban areas without green space. Green spaces may positively affect health by encouraging physical activity, facilitating social cohesion and reducing stress (de Vries et al., 2013). Green space availability is negatively correlated to feelings of loneliness by way of its positive correlation to perceived social support (Maas et al., 2009). Maslow’s Hierarchy of Needs, which distinguishes important elements of psychological wellbeing, highlights the need for belonging within a larger group or community as one of those elements. In his 1943 paper, Maslow asserts that, “...the thwarting of these needs is the most commonly found core in cases of maladjustment and more severe psychopathology” (Maslow, 1943, p. 9). Jennings and Bamkoke (2019) note that feelings of acceptance and connectedness, trust, and belonging within a society are elements of social cohesion. Furthermore, research shows that social cohesion is associated with psychological wellbeing and as an intervention to negative health issues such as obesity, stroke, cognitive decline, smoking and excessive alcohol consumption (Jennings & Bamkoke, 2019).

Horticultural Therapy

Horticultural therapy (HT) is defined by the American Horticultural Therapy Association (2017) as the process by which participants work towards a goal through involvement in horticultural activities. Although formal HT training only began in the U.S. in the 1970s, humans have recognized the therapeutic benefits of nature since ancient Egypt (Simson & Straus, 1998) and Mesopotamia (Scott, 2017). Horticultural activities were initially used to treat mental illnesses and physical disabilities (Simson & Straus, 1998) but have been found to reduce stress and positively affect one's perception of wellbeing, promote socialization, and provide job skills to those with disabilities (Kamioka et al., 2014). HT has also been used for treating addiction (Shechet, 2019) and posttraumatic stress disorder (Jenkins, 2016). The overarching goal of HT research is to assess the effects of plants and horticultural activities on psychological, social, cognitive, and physiological functioning (Scott, 2017).

The potential positive effects of education in the garden on a range of psychological facets has been made widely apparent through anecdotal evidence and research (Jenkins, 2016; Linden, 2015; Shechet, 2019; Schimke, 2013). In Loveland, Colorado, 13 to 18-year olds with behavioral and emotional problems find acceptance and learn vocational and life skills in a series of summer gardening programs designed for at-risk adolescents or youth with special needs (Schimke, 2013). Parents and participants praise the programs as safe environments to explore independence and communication (Loveland Youth Gardeners, n.d.). North Carolina's 4-H programs also incorporate environmentalism, socialization, and critical thinking into the gardening and agriculture curricula (Mid-Atlantic Horticulture Therapy Network, n.d.). Kim et al. (2012) examined the effect of HT on attentiveness and sociality in children with intellectual impairments in South Korea. Although no significant changes in attention were observed

between the HT and control groups in this study, the researchers found that sociality was increased for children who participated in the HT group compared to the control (Kim et al., 2012).

Horticultural programming has also demonstrated effectiveness in improving mental health of juvenile and adult offenders. The Green Brigade is a diversion program for juvenile delinquents in San Antonio, Texas. After participation in the program, self-esteem scores of the delinquent youth increased to levels comparable to those of the control group (Cammack et al., 2002). Delinquent youth participants of a gardening project in southwestern Ohio developed positive social behaviors and empathy, communication skills, and feelings of belonging and responsibility to society (Twill et al., 2011). The project provided a platform for participants to develop job skills, enjoy recreational activities in greenspace, and to donate surplus food to local shelters (Twill et al., 2011). Five prison gardening programs across the U.S. are described in a 2016 report by Rachel Jenkins: GreenHouse at Rikers Island in New York City, Insight Garden Program in San Francisco, Roots to Re-entry in Philadelphia, Master Gardener Program in Bryan, Texas, and Marion County Sheriff's Office Inmate Work Farm Program in Ocala, Florida. Adult inmates who participated in these programs experienced increases in self-esteem and self-worth and decreases in anxiety and depression (Jenkins, 2016; Migura et al., 1997; Linden, 2015).

Limitations to Current Horticulture Therapy Research

Unfortunately, many scientific studies on the effects of HT have insignificant or mixed results. Some researchers have attributed this to variances in program length and duration (Cammack et al., 2002; Migura et al., 1997). It is equally likely that the qualitative and anecdotal nature of HT studies dilutes the validity of the results (Jenkins, 2016; Twill et al., 2011).

Although one might expect quantitative studies to prove otherwise, Kamioka et al. (2014) concluded that the leading factor contributing to weak results in randomized controlled trials published between 1990 and 2013 is the lack of homogeneity and quality in methods and reporting.

Conclusions

The global population is steadily increasing, and urbanization is expected to dominate developed land by 2050 (United Nations, Department of Economic and Social Affairs, Population Division, 2019a; United Nations, Department of Economic and Social Affairs, Population Division, 2019b). This shift away from rural living is partly responsible for the evolution of our population as it advances technologically and electronics become a ubiquitous part of life (Pergams & Zaradic, 2006). Despite the value of these advances, they come at the cost of Mother Earth and our wellbeing. The amount of green space on the earth is declining as the global population increases, which has led to concerns regarding soil quality and food security (European Space Agency, 2017; Schneider et al., 2011). Americans' desire to interact with nature is also declining as green spaces shrink (Pergams & Zaradic, 2006), an effect described by nature-deficit disorder (Warber et al., 2015; World Conservation Congress, 2012). Increased academic pressures from federal mandates have put pressure on the American education system to show academic achievement in a narrow range of subjects (Jennings & Rentner, 2006), increased student stress to a dangerous level (Hansen & Lang, 2011), and reduced students' access to nature either directly during school or indirectly due to increased workload and assessments (Warber et al., 2015).

At home, adults lack trust in their neighbors and parents discourage outside play for fear of their children being abducted (Playday, 2010). Our society is generally spending less time

outside and it is affecting us physically, psychologically, and socially (de Vries et al., 2013). To date, programming exists for the purpose of furthering education, vocational skills, or social-emotional and behavioral skills (Cammack et al., 2002; Jenkins, 2016; Kamioka et al., 2014; Kim et al., 2012; O'Connor et al., 2014; Schimke, 2013; Shechet, 2019). These programs target all age groups but are aimed specifically at those with disabilities or considered to be at-risk (O'Connor et al., 2014).

Researchers have been working to validate anecdotal evidence of the positive effects of nature and horticulture therapy, and to bring light to the potential usefulness of nature as an intervention (Linden, 2015; Maas et al., 2009; Shechet, 2019; de Vries et al., 2013; White et al., 2013). Despite encouraging research that provides support for the positive effects of interaction with nature on biological, psychological, and social elements, there appears to be an absence of programming that incorporates all these goals and is generalized for all groups. In a world where individuals experience extreme levels of stress, are distracted by screens, and lack a supportive social network, it is essential that efforts be made to explore and utilize research-based programming that has shown promise in improving physical, mental and spiritual health, and social cohesion and trust.

Theoretical Framework

The biopsychosocial (BPS) approach to psychiatric health was developed by Dr. George Engel in the late 1970s (Tripathi et al., 2019). In contrast to the traditional biomedical models of disease and illness, the BPS model emphasizes the interdependent relationships between biological, psychological, and social factors of health and wellbeing (Engel, n.d.). Biological factors include the physical composition and bodily processes that interact to affect health, such as the relationship between the immune and circulatory systems. The psychological component

includes emotional, attitudinal, cognitive, motivational, and behavioral elements that interact to affect health, as illustrated by the impact of self-regulation on substance abuse. Interpersonal dynamics involve the actual or perceived effects of social interaction on health, for example, the interaction of peer pressure on the development of positive or negative behaviors (Lehman et al., 2017). Research on the influence of genetics on the development of psychiatric disorders, such as schizophrenia, demonstrates evidence for the connection between physical and mental facets of health (Tripathi et al., 2019). The placebo effect is another example of the biological-psychological connection, such that false surgeries encourage neural pathways involved in pain perception to become less active (Lehman et al., 2017). Dodge and Pettit (2003) emphasize the importance of the BPS model for understanding the development of chronic conduct problems. The researchers define development as the combination of biological predispositions, sociocultural context, and early life experiences. These elements interact throughout life and development in a predictive manner that increases or decreases antisocial behavior (Dodge & Pettit, 2003).

Modern healthcare is criticized for its limited concern for diagnosis and intervention as dictated by those who allocate funding. This one-sided view of illness fails to recognize the reciprocal relationships between body, mind, and sociality and is reminiscent of the one-size-fits-all education directive in the U.S. The BPS model offers reprieve from generic biomedical models of healthcare by emphasizing individualized, patient-centered care (Wade & Halligan, 2017). Healthcare providers using the BPS framework are encouraged to acknowledge a patient's personal history to contextually relate life circumstances to current health. Similarly, patients are encouraged to utilize self-awareness to aid diagnosis and treatment. The multidimensional treatment that is characteristic of BPS is dependent on clinicians' choices of

which aspects of biological, psychological, and social elements are most important to providing care to the patient (Engel, n.d.). Whereas the pharmaceutical-focused biomedical model is overly generalized and costly, the BPS approach involves lifestyle and behavior modification to provide individualized, holistic healthcare (Fava & Sonino, 2008).

Despite a high number of deaths that can be attributed to behaviors and exposure to unhealthy activities and lifestyles, most healthcare spending is still directed at traditional biomedical models (Fava & Sonino, 2008). However, an increasing body of research is building that supports the validity of the BPS framework in healthcare (Wade & Halligan, 2017).

Kisnanto et al. (2018) recognize the potential for BPS in treating chronic illness (e.g. diabetes, chronic pain, and chronic obstructive pulmonary disease (COPD)) and functional disorders (e.g. irritable bowel syndrome, fibromyalgia, and chronic fatigue syndrome) in which physical ailments are associated with pain, stress, fatigue, depression, and anxiety. Postpartum women experiencing depression, dissatisfaction with body image, disordered eating, and negative attitudes toward breastfeeding also benefited from BPS intervention (Rodgers et al., 2018).

Marianne Frankenhaeuser (1989) noted that personal control acts as a buffer to job stress by decreasing dissatisfaction with work and subsequent negative physical stress responses, and by increasing active participation, which in turn increases self-esteem (Frankenhaeuser, 1989). The BPS model has also been adapted to include a spiritual component. The biopsychosocial-spiritual (BPS-S) model has been used in certain contexts and with particular populations that call for the added element. Klawonn et al. (2019) studied the effects of panchamaya kosha yoga, which takes spiritual health into consideration, when combined with the BPS-S model on graduate healthcare students and found that the combination of the two models significantly improved mindfulness, self-compassion, depression, stress, and anxiety in the participants (Klawonn et al., 2019). The

BPS-S approach has also been successful with populations and individuals with strong religious and spiritual beliefs. Al Ghaferi et al. (2016) explored the applicability of the BPS-S model as an addiction intervention in Islamic countries. Although substance abuse was linked to family history, diminishing social interaction, and the cyclical relationship between emotional instability and addiction, spirituality was observed to be an important protective factor (Al Ghaferi et al., 2016). Similarly, Taylor et al. (2013) found that the BPS-S approach was effective at mediating pain in adults suffering from sickle cell disease. The BPS-S approach adds another potentially protective element to the multidimensional treatment of individuals who place high value in spirituality (Klawonnet al., 2019; Al Ghaferi et al., 2016; Taylor et al., 2013).

The BPS framework has also shown promise in the realm of horticulture and gardening (George, 2013). Irvine and Warber (2002) suggest several mechanisms by which the BPS model is appropriate in combination with interaction with nature as a healthcare intervention. The cognitive psychology-based attention restoration theory (ART) proposes that “interaction with nature is important for effective mental functioning, such as learning new information, performing complex tasks, or problem solving” (Irvine & Warber, 2002, p. 78). ART is based on the assumption that involuntary attention to the natural environment allows voluntary attention time to rest, which aids in the restoration of the ability to concentrate on unengaging stimuli. Another theory posits that interaction with nature is a mediator to negative physiological symptoms of stress (Irvine & Warber, 2002). The BPS model has been further modified by garden therapists in German speaking countries to include ecology as a fourth dimension. This approach acknowledges the direct influence of participating in the garden on the greater health system (Haller et al., 2019). The proposed BPS-type frameworks account for the complex interactions of all aspects of health and development as they relate to treatment of diverse

populations in various contexts (Dodge & Pettit, 2003, Klawonn et al., 2019; Al Ghaferi et al., 2016; Irvine & Warber, 2002).

CHAPTER THREE

PROGRAM OVERVIEW

Target Population

The Nature of Us is intended to target 15-16-year-old teenagers. This age group is preparing to enter the workforce and those youth not already engaged in extracurricular programs are likely in need of the benefits of this curriculum. Additionally, teenagers represent a group that is beginning to make connections between basic and abstract ideas. With encouragement and guidance, they can break bad habits and make healthy choices that lead to long lasting change.

As it is the author's hope and intention that this curriculum be applicable in a variety of contexts with diverse populations, 15-16-year-old teenagers were chosen as the target population because they represent a middle-of-the-road population. This allows instructors to increase or decrease the difficulty of the concepts and activities to fit the needs of their individual groups or students. It is unreasonable to assume that a curriculum could be developed by a third party that captures the unique needs of every student without adjustments and personalization. Instructors gain the trust of their students by understanding their individuality and it is important that instructors using this curriculum tailor the activities to their students' specific needs.

Similarly, *The Nature of Us* can and should be adjusted to fit the needs of various contexts and program types. The curriculum can be integrated into existing programs such as academic courses, 4-H clubs, Master Gardener associations, Parks and Recreations programs, and others. The BPS framework allows to individuality to guide the experience and can also include a spiritual component, which broadens the range to include faith-based programs.

Method of Curriculum Development

The spirit of this curriculum encompasses a wide range of horticultural and health concepts. Through research of existing courses and programs, it became clear that a myriad of topics and activities exist and that there is no formula for the perfect curriculum. With consideration to the target population, five topics that are appropriate for an introductory horticulture class were chosen for the outline of *The Nature of Us*: Planning, Preparation, Maintenance, Nutrition, and Harvest (Table 1).

Table 1
Outline of Topics Addressed in the The Nature of Us Curriculum

Unit	Lesson	Learning Objectives
Planning	Green Space	<ol style="list-style-type: none"> 1. To define green space and discuss the various types and purposes of green space. 2. To define and apply the basic elements and principles of landscape design to green space design. 3. To analyze the purposes of and emotions evoked by green spaces.
Preparation	Soil	<ol style="list-style-type: none"> 1. To define green space and discuss the various types and purposes of green space. 2. To define and apply the basic elements and principles of landscape design to green space design. 3. To analyze the purposes of and emotions evoked by green spaces.
	Anatomy	<ol style="list-style-type: none"> 1. To explore levels of organization of biology and needs. 2. To compare the major anatomical functions of plant and human systems.
	Seeds	<ol style="list-style-type: none"> 1. To identify and define parts of a seed. 2. To understand and practice seed germination. 3. To compare Maslow's Hierarchy of Needs and Frankl's Logotherapy.
Maintenance	Weeds	<ol style="list-style-type: none"> 1. To define weeds and demonstrate proper weeding technique. 2. To analyze the value of perspective.
	Pruning	<ol style="list-style-type: none"> 1. To define and explore proper pruning techniques. 2. To investigate goal setting and execution.
Nutrition	Nutrition and Balance	<ol style="list-style-type: none"> 1. To define macro and micronutrients. 2. To explain the effects of the rhizosphere and microbiome on plant and human nutrition. 3. To explore the effect of the synthetic fertilizer as compared to organic fertilizer on plant growth and development. 4. To explore the effects of an unbalanced diet on human growth and development.

Unit	Lesson	Learning Objectives
Harvest	Challenging Preconceptions	<ul style="list-style-type: none"> - To differentiate between botanical and culinary definitions of fruits and vegetables. - To consider the roles that prejudice and stereotypes have in the agricultural and food and beverage industries. - To evaluate the program's activities as they pertain to participant satisfaction, self-esteem, and resilience.

The first part of the curriculum development involved a variety of resources that outline specific lessons and activities in the present curriculum including education blogs, literature published by the U.S. Department of Agriculture, articles from the Horticulture Therapy Institute, university extension publications, and peer-reviewed articles. Of particular importance was the curriculum developed by the Horticultural Society of New York for at-risk youth. This curriculum was utilized because it includes lesson plans, activities, and procedures specific to the target population (Cannizzo, 2010a). These lessons and activities were modified to increase flexibility of instruction with regard to methods, materials, and assessment.

Second, the author incorporated BPS objectives into the horticultural lessons. This was accomplished by identifying sources that support and parallel the horticultural concepts. A list of resources similar to those used to develop the horticulture learning objectives was used to research the BPS learning objectives. To a degree, the BPS objectives are abstractly related to the horticulture objectives and the activities themselves serve to connect the two topics. The author felt that this allows instructors the ability to create their own activities and lessons that are not included in the present curriculum, and to create a unique experience for participants.

Lastly, the development of *The Nature of Us* included research that outlines specific activities that involve horticulture and non-academic objectives. Swank and Swank (2013) describe the process of developing a garden program for children that utilizes a social-ecological framework and emphasizes positive change in growth and development. Lieber and Tissiere's

(2017) article presents information relative to social and emotional learning with high school students. In addition to examples of lessons and activities, the authors explain where and how to use this type of learning to develop positive relationships and resilience, and to foster academic support (Lieber & Tissiere, 2017). Hoffman et al. (2007) outline gardening activities that encourage social interaction between undergraduate students. The intent behind these activities is to promote self-esteem while reducing ethnocentrism (Hoffman et al., 2007).

Instrumentation and Data Collection

A group of professionals with experience in education, horticulture therapy, and horticulture programming was employed in the evaluation of the curriculum and provided feedback about its appropriateness and efficacy. The author initially contacted eight professionals via phone and email, inquiring about their desire and availability to assist with the curriculum evaluation. Several of these individuals had been recommended by the graduate advisory committee and others were individuals that the author had developed relationships with over the course of her graduate studies. The author also researched local programs, such as 4-H, Master Gardener, botanical gardens, and high schools, that would be appropriate contexts into which the curriculum could be incorporated. To provide background information and context, the author presented a distillation of the curriculum and a copy of the project proposal to the professionals in the email inquiry. Two of the professionals did not respond to the attempts at contact and two declined the offer due to other commitments. The final panel included a horticulture therapist, a horticulture program director, a high school horticulture teacher, and a dance educator, all of whom work in the state of Virginia. The dance educator was invited to participate because she is an instructor who is not involved in horticulture. The author wanted an outside perspective to determine if *The Nature of Us* could be incorporated into non-horticulture

programs. The author then discussed the process of involvement with the panel members, which included how the units and Excel evaluation documents would be electronically delivered via email, the format of the evaluation and expectations of responses, and the two-week timeframe in which the evaluations were required to be returned. The panel's feedback and evaluations guided the modifications and adjustments made to improve the curriculum. The author and the panel members corresponded through email to discuss incorporating specific comments and suggestions. Appendix A includes the revised curriculum and lesson plans that resulted from the correspondence and evaluations. Unfortunately, one of the experts was unable evaluate the preparation and maintenance units. This is reflected in a change of percentages in the Likert scale scores for those two units and denoted in the tables presented in Chapter Four.

CHAPTER FOUR

PROJECT OUTCOMES

The evaluation spreadsheets completed by the panel of professionals included a 5-point Likert scale and open-ended questions. The Likert scale responses were rated as 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, and 5 = strongly agree. The total score for each unit evaluation was calculated by adding the numeric rating, which resulted in a potential range from 11 being the worst and 55 being the best. The unit totals from each professional were then averaged to determine the mean total score for the corresponding unit. The Likert scale responses of each unit evaluation were also combined to calculate the percentage of professionals that chose the corresponding score. The open-ended questions allowed the professionals to identify shortcomings in the lessons and provide suggestions for improvement. The following tables

(Tables 2-6) contain the Likert scale statements and responses used for the evaluations, and display the percentage for each response.

Table 2

Planning Unit Evaluation Responses – Average Score: 50/55

N = 4	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The lesson is easy to follow.				75%	25%
The methodology is clear.	25%			25%	50%
The lesson accomplishes the learning objectives.					100%
The activity can be completed in the time frame denoted.		25%	25%	25%	25%
The assessments provide adequate feedback on the lesson.			50%		50%
The additional resources support the learning objectives.					100%
The activities are engaging.				25%	75%
The content is age appropriate.					100%
The tools and materials are adequate.					100%
The connection between plants and humans is tangible.					100%
The lesson could easily be integrated into my existing program.				25%	75%

“What weaknesses exist?”

- Wise use of time. Green spaces is a fairly simple concept to understand but there is a lot of time spent teaching it. Principles and Elements of design are a little more complex and subjective and require more time to which there is not as much dedicated.
- I think you need them to do peer reviews of each group project based on the 3 Essential Questions, reinforcing the information and providing data for evaluation of the lesson.
- This is an excellent esteem builder for youth, to create something beautiful, however, teaching design may take more than 30 minutes.
- This lesson is very strong. The only “weakness” (I’m not sure this really is one, but one to think about), is that kids in this age demographic grew up with an immense amount of technology at their disposal. So to them, there may or may not be an “increase” in electronic use that they are able to note in their daily lives, as mentioned in the methodology for Activity 1. I believe the students I work with would enjoy this lesson.

“What challenges do you foresee with this activity?”

- Will students know what they’re doing with the design if they don’t know how to design?
- Many youth struggle with envisioning and creating from scratch.

- Evaluating different learning levels, often we had youth that were frustrated by the time it took to complete lessons, while others were rushing ahead.
- I think this lesson is very straight forward and allows more non-linear, creative thinkers a chance to really shine due to the artistry this activity provokes. That being said, students who prefer less artistic endeavors may find this activity overwhelming and quite difficult. This is not a weakness, just a challenge I can foresee facing some students to be mindful of.

“How could the lesson be improved?”

- You may wish to teach about other factors to consider for landscape design such as year round appearance of plants, choosing low maintenance plants, how to consider the full grown size of the plants, selecting non-poisonous or harmful (thorny) plants, considering native plants or those which are best for the hardiness zone, soil, etc.
- Define Basic Elements and Principles in the Learning Objectives or in Vocabulary section.
- This could easily take a longer period of time offered as a course?
- As it stands I think this lesson is very strong in purpose and execution.

Table 3

Preparation Unit Evaluation Responses – Average Score: 52/55

N = 3	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The lesson is easy to follow.				33%	66%
The methodology is clear.				33%	66%
The lesson accomplishes the learning objectives.				33%	66%
The activity can be completed in the time frame denoted.				33%	66%
The assessments provide adequate feedback on the lesson.				33%	66%
The additional resources support the learning objectives.				33%	66%
The activities are engaging.					100%
The content is age appropriate.					100%
The tools and materials are adequate.			33%		66%
The connection between plants and humans is tangible.				33%	66%
The lesson could easily be integrated into my existing program.					100%

Note. Youth horticulture program director was unable to evaluate this lesson.

“What weaknesses exist?”

- The only thing I'm really wondering about this lesson is does it assume that they know these vocabulary terms before the lesson? If not, instruction should be intentionally made to teach them this.
- A jeweler's loupe may be added for close observation of living organisms in soil.
- The time expectations may be slightly limiting due to the group-work nature of these activities. To ensure that all students in each group are actively participating and contributing, slightly longer time parameters OR peer evaluations to be calculated in with the final grade on the assignment might be beneficial

“What challenges do you foresee with this activity?”

- None, really
- Teaching differences between soil (life giving) & “dirt.”
- Depending on the teacher's rapport with his or her students and the general rapport of the class as a whole, students may find it intimidating to share truthful experiences of a time they felt out of control physically, emotionally and/or socially. An alternative to this activity for students who may not feel comfortable sharing personal details about themselves might be to find an article in a local newspaper depicting systems "out of control"- a house fire, car accident, accidental death, etc. And complete the assignment from there.

“How could the lesson be improved?”

- Making connections to why is the information important.
- Loupes as mentioned. Observation when water is added, drainage or sponge-like way examples hold water (clay vs. sand vs. loam).
- Very thorough. With the amount of group work present in this activity, my only suggestion as mentioned above would be to have students grade one another on participation as well in order to make ensure everyone took part and has somewhat of a basic understanding of the objective.

Table 4

Maintenance Unit Evaluation Responses – Average Score: 53.33/55

N = 3	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The lesson is easy to follow.				33%	66%
The methodology is clear.			33%		66%
The lesson accomplishes the learning objectives.					100%
The activity can be completed in the time frame denoted.					100%
The assessments provide adequate feedback on the lesson.				33%	66%
The additional resources support the learning objectives.				33%	66%
The activities are engaging.					100%

N = 3	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The content is age appropriate					100%
The tools and materials are adequate.					100%
The connection between plants and humans is tangible.					100%
The lesson could easily be integrated into my existing program.					100%

Note. Youth horticulture program director was unable to evaluate this lesson.

“What weaknesses exist?”

- The discussion on why to prune is repetitive. It's important as an educator to repeat important information, but maybe try to change up how this is done. So instead of a discussion, have an activity instead.
- Excellent approach towards self-examination. More discussion in “pruning out” negative thinking, beliefs & associations.
- None.

“What challenges do you foresee with this activity?”

- Students are probably not going to be able to pay attention while they are weeding out the garden. Even if they can hear you, their responsiveness will be less or your ability to gauge their understanding will be difficult
- None noted, other than obvious weather, ticks, resistant participants unfamiliar with material world & related fears.
- None.

“How could the lesson be improved?”

- When they set goals, they can use what's called a SMART goal. Many schools teach this at some point, so they might be familiar with it already. You might also want to make it 2-3 goals. They might not realistically have 5 goals they are aspiring for at their age.
- Comparison to a tree or herbaceous plant, strong roots (foundation & education) lead to the Maslow's self-fulfillment, each limb or branch of participants life can add to goals (positive hobbies/friends) or need pruning.
- I really enjoy this lesson! I do not see any need for improvement. In fact, I think this would be a wonderful unit to incorporate into school systems in younger classrooms, while maybe watering down some of the more intricate science-based information depending on grade level to help younger students begin to make tangible connections between creating goals, maintaining the positive habits needed to cultivate these goals, and eventually achieving them.

Table 5

Nutrition Unit Evaluation Responses – Average score: 51.25/55

N = 4	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The lesson is easy to follow.			25%	25%	50%

N = 3	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The methodology is clear.				25%	75%
The lesson accomplishes the learning objectives.				50%	50%
The activity can be completed in the time frame denoted.				50%	50%
The assessments provide adequate feedback on the lesson.			25%	25%	50%
The additional resources support the learning objectives.					100%
The activities are engaging.				25%	75%
The content is age appropriate.					100%
The tools and materials are adequate.				25%	75%
The connection between plants and humans is tangible.				25%	75%
The lesson could easily be integrated into my existing program.				25%	75%

“What weaknesses exist?”

- Clarity on what is to be done in one lesson. Also more detail on how information is to be taught.
- I would like to see a look at the changes that are taking place from traditional farming to more types of “sustainable” agriculture.
- None noted
- This lesson is very strong. It is engaging both in non-tangible content and hands-on processes. I believe the students I work with would enjoy this lesson.

“What challenges do you foresee with this activity?”

- How the time will be spent during the 4 weeks of growing, and how the instructor will present and assess knowledge.
- You need to make sure the organic mix has compost in it. I would also cut open the bottles to check out the rhizosphere of the two different systems.
- Always being mindful if there are obese kids within group setting, presenting information with this in mind..
- For activity 2: Some students, especially at this age, may not be truthful in their answers for what snack or beverages they consumed over the three-day period, especially if these results are to be displayed to the class due to possible embarrassment or comparison. An alternative route to retain a similar purpose may be to have students submit these entries to you only, and then you present them at random to the class, so that confidentiality is maintained.

“How could the lesson be improved?”

- Ultimately, you need to include transitions between the items and specifics on how it’s supposed to be taught. Just verbally explaining a definition and moving on from it will cause many participants to forget it or think it is unimportant to the goal of the lesson.
- See above [comment].

- There is a study out there in the prison system that utilized Alcohol, Soda and Cigarette ash water as demonstration.
- As it stands I think this lesson is very strong in purpose and execution. As I mentioned above, 15-16 year olds may find it more difficult to be honest and forthcoming about their nutritional habits to their peers-- using confidentiality methods here might improve the validity of this activity.

Table 6*Harvest Unit Evaluation Responses – Average Score: 50.25/55*

N = 4	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The lesson is easy to follow.			25%	50%	25%
The methodology is clear.				25%	75%
The lesson accomplishes the learning objectives.			25%		75%
The activity can be completed in the time frame denoted.			25%	25%	50%
The assessments provide adequate feedback on the lesson.			25%	50%	25%
The additional resources support the learning objectives.					100%
The activities are engaging.				25%	75%
The content is age appropriate.					100%
The tools and materials are adequate.				50%	50%
The connection between plants and humans is tangible.				25%	100%
The lesson could easily be integrated into my existing program.				50%	50%

“What weaknesses exist?”

- Needs transitions, review of information, and an assessment on all information learned
- I think a better approach to discrimination would be to look at race and gender issues related to agriculture and the food industry.
- Funders often want more measurements in the area of positive behavior changes, such as your self-esteem section.
- I personally found this lesson to be the most engaging out of the three on a purely human-level. While I am not positive an immense amount of academic knowledge (again, I'm not positive because this is definitely not my area of expertise) would be obtained as compared to other lessons, I do think societal knowledge of biases and prejudices would be more heavily explored in this lesson than the others.

“What challenges do you foresee with this activity?”

- While the connection between plants and humans is clear, they seem like two separate lessons. Participants might get lost in the overall goal of the lesson because it doesn't come back full circle in the end.
- A lot of prep work will be needed to make sure the participants can connect the dots.
- Depending on the population, conflict could arise during the group and the facilitator should be prepared for redirection or deescalation of class.
- At first, you may find students feel a little awkward or withdrawn in giving their commentary and perceptions as it pertains to people (I've found the more diverse a population of students, the more reserved students sometimes feel in relaying their opinions as to not inadvertently offend someone, whether their opinion or statement is actually offensive or not. Something to also consider), of various biases that you mentioned in your lesson. Is it possible to draw from historical lessons on political bias, racial bias and prejudice to "get the ball rolling" in a sense, and somehow relate these misconceptions to those relevant to fruits and vegetables?

“How could the lesson be improved?”

- In activity 1b, what are they going to do with this reflection? It's personal so they shouldn't share it with the class unless they want to. Instead, I might try having students “write a letter” (it won't be sent to anyone) that clearly explains what prejudice is and why it is wrong. In this letter, they can explain the metaphor between fruits and vegetables.
- See above.
- This is an excellent program to engage youth, it would be nice to have more measurement tools built into Assessment
- As it stands I think this lesson is very strong in purpose and execution.

CHAPTER FIVE

DISCUSSION

The curriculum was developed to bridge a gap that exists in current education and programming. It is intended to be an introductory course to horticulture that piques the interest of teenagers preparing to enter the workforce and encourages them to think abstractly about their physical, psychological, and social health. By drawing parallels between the natural world and themselves, participants will gain an appreciation for the connection that exists between all things. The curriculum maintains a sense of flexibility that allows instructors the opportunity to

tailor the experience to the specific needs of the participants and to incorporate the curriculum into an existing program.

The Nature of Us builds on the techniques and elements found in existing curricula and research-based programming. Historically, horticulture programs have been utilized in the correctional system to provide vocational training to inmates (Coppedge & Strong, 2013) and this is echoed by various horticulture programs outside of the penal system (Kamioka et al., 2014; Schimke, 2013; Twill et al., 2011). One of the primary goals of this project was to develop a curriculum that provides vocational training that will give the participants the advantage when pursuing a career in horticulture. The development of job skills has been correlated to increases in self-esteem and feelings of self-worth (Jenkins, 2016). According to research from Mayer et al. (2008) and MacKerron and Mourato (2013), participants simply engaged in activities outdoors or in natural environments also experience increases in happiness and positive emotions. These are expected results of this curriculum that would best be measured by a psychological test, such as the Psychological Well-Being (PWB) scale developed by Carol D. Ryff in 1989. This scale has been used successfully with Americans of all ages and differing backgrounds (SPARQtools, n.d.).

Additionally, socialization is an important tenet of this curriculum. Feelings of loneliness have been found to be negated by green space and the connection to social support (Maas et al., 2009) and the social cohesion experienced during this curriculum is expected to increase the psychological wellbeing of the participants (Jennings & Bamkoke, 2019). Programs such as ACCEPTS, PATHS, Connecting with Others, and 4-H similarly emphasize the importance of social cohesion (Connor et al., 2014; Mid-Atlantic Horticulture Therapy Network, n.d.). Furthermore, researchers have found that engaging with nature allows individuals to think

abstractly about life problems (Mayer et al., 2008). Through reflection and discussion, it is expected that participants will gain the ability consider other perspectives, which in turn can reduce prejudice (Goldstein, 1999; Mid-Atlantic Horticulture Therapy Network, n.d.).

Due to its foundation in research-based programming, *The Nature of Us* has the potential to be used in a wide range of contexts. Many of the horticulture and BPS learning objectives found in the curriculum align with national and state education standards set forth by the education mandates discussed previously, which would allow straightforward integration into the public-school system (Education World, n.d.). With an emphasis on stewardship, critical thinking, and socialization through exploration in the garden, this curriculum would also complement 4-H courses and could easily be assimilated into current programs (Mid-Atlantic Horticulture Therapy Network, n.d.). A number of horticulture-based programs exist that provide job skills, life skills, and a therapeutic environment for participants that have experienced life-changing events or injuries, such as adult offenders, delinquent youth, and veterans (Cammack et al., 2002; Eichholz, 2020; Hillman, 2019; Linden, 2015; Migura et al., 1997). The lessons and activities found in the present curriculum attempt to enhance self-esteem and positive emotions, further develop communication, and rebuild trust in oneself and one's community, which are essential goals of programs for these populations. Through the hands-on interaction with nature, learning to nurture living organisms, and expanding perspectives, *The Nature of Us* provides a platform for the formation of new identities and bright futures for participants.

Conclusions

The Nature of Us curriculum was created and distributed to a panel of four experts that included a horticulture therapist, a horticulture program director, a horticulture educator, and a dance educator. The panel provided feedback on and evaluated the lessons and activities in each

unit using a 5-point Likert scale and open-ended questions. Due to the differing professions and backgrounds of each panel member, responses to the evaluation varied significantly. The panel gave responses regarding the educational aspects and lesson plan elements that scored lower on the Likert scale and required more revisions than the abstract components that differentiate this curriculum from others. The open-ended responses provided insight and suggestions for simplifying or restructuring the methodology and altering lessons to increase efficacy. The author relied on the experience of and feedback from the professional panel to make the following specific changes.

1. The time frame for each activity was adjusted to account for delays and issues that may arise during the presentation of the material. A 60-minute time frame was adopted to accommodate the time constraints of most existing programs.
2. The introductions to each unit were also modified to include more background information for the instructor and participants.
3. Redundancies noted in the lessons were amended by altering the method of instruction (e.g. visual instruction, hands-on instruction, and verbal instruction) and by condensing the activities to maintain the attention of the participants.
4. The verbal cues used in the Harvest unit activities were modified to align with agriculture-based issues, which focused the discussions and reflections on horticultural concepts and brought clarity to the lesson.

The author chose to make limited alterations to the tools, materials, and assessments to retain flexibility. The potential users of this curriculum are assumed to be associated with a range of contexts that include traditional education, after-school programs, church groups, 4-H clubs, and therapy. Each of these contexts has varying access to tools and materials, and each

context utilizes and measures success differently, thus requiring flexibility in application.

Despite the panel's unified opinion of the assessments as a weak point, the panel unanimously agreed that the curriculum could easily be integrated into their existing horticulture- and non-horticulture-based programs.

For more information regarding the specific feedback made by the expert panel, please refer to the Project Outcomes found in Chapter Four.

Recommendations

Several limitations of *The Nature of Us* curriculum exist. Although the panel of professionals represented a diverse group of program instructors that would benefit from the curriculum, the panel only consisted of four individuals. Additionally, the author was unable to run a pilot due to the Covid-19 pandemic and subsequent lockdown. It is recommended that this curriculum be tested on a group of 15-16-year old teenagers and reevaluated using the participant evaluation spreadsheet (Appendix C). Similarly, a larger group of professionals should evaluate the curriculum to increase the reliability and validity, and use a 10-point Likert scale to increase accuracy of feedback.

As each group of individuals has unique needs, it is essential that instructors modify the curriculum to fit the needs of their students. The complexity of the activities presented in the curriculum should be adjusted based on the maturity and level of knowledge of the participants. Similarly, the tools and materials included in the present lessons are minimal to increase the likelihood that all programs can teach the curriculum as is. Instructors may increase the difficulty of the lessons by including more advanced tools and materials, such as scales, graduated cylinders, knives, and hand tools, if they are available and appropriate for the participants.

Instructors using this curriculum will benefit from the following suggested formative student evaluation techniques. Participants should be able to demonstrate their understanding of course concepts and plant science through essay-based assessments, practical demonstrations, and projects. Changes in wellbeing can be measured through psychological tests administered in a pretest-posttest format, such as the Psychological Well-being (PWB) scale (SPARQtools, n.d.). Changes in wellbeing can also be evaluated through journal reflections and observation of individual and group activities. Instructors and students should also utilize summative evaluation to assess the strengths and weaknesses of curriculum implementation to ensure effective programming. This can be accomplished through reflections, surveys, and the participant evaluation (Appendix C). Similarly, the curriculum would benefit from evaluations made by various stakeholders. This group could include heads of superior departments, counselors, family members, managers, parole officers, and other individuals dependent on the specific context.

Lastly, it is imperative that each participant has a notebook for this curriculum. The participants will use the notebooks to record observations and to store the handouts and worksheets used in the lessons. The notebooks also serve as a means of assessment. The participants will submit the notebooks to the instruction after responding to prompts, developing group presentations, and completing written assignments. Most importantly, the notebooks will be used by the participants to enter reflections, which are an essential facet of the curriculum. The general reflections will be graded based on content upon notebook submission, but the private reflections should remain confidential and be assessed as complete or incomplete. It is the hope that the participants will keep the notebooks for future reflections and observations after the curriculum has been completed.

This curriculum serves as a starting point for further development of horticulture-based programming that incorporates concepts related to physical, psychological, and social health. To expand on this curriculum, it is recommended that future development includes concepts like those found in the EQUIP program, such as anger management skills which participants practice with each other through group activities and reflection (Gibbs et al., 1999), and the Second Step program, which promotes positive relationships with adults to protect young people from substance abuse, delinquent behavior, and violence (O'Connor et al., 2014). Current research-based programs can provide a myriad of additional components that could be incorporated into this curriculum to enhance its impact.

Additionally, there are several modifications that can be applied to this curriculum to increase applicability and relevance to different target populations. The Nature of Us could be utilized with populations younger than 15-16-year old teens but it would be imperative that the concepts be distilled, the lessons be simplified, and the number of hands-on activities be increased. For older populations, it is important to consider this group's relationship to the natural world. This could be accomplished by incorporating important life events into the lessons and adjusting the discussion topics through dialogue-based modifications to increase palpability for the cohort. Similarly, contextual modifications would allow the curriculum to be applied to urban versus rural populations, such as the prevalence of green space and food access. Another group that would benefit from this curriculum are those transitioning back into society from abnormal circumstances. As discussed earlier, previously incarcerated individuals and veterans undergo intense transformation and change due to their environments and training. It is essential that these individuals explore new ways to create meaning, form identities, and reconnect with themselves, and employing a connection to the natural world could be beneficial in this process.

It is also noteworthy to comment on the situational accessibility of this curriculum. Although physical activity plays an important role and is encouraged in the lessons and activities, modifications should be considered for individuals with limited mobility. Assessing the physical abilities of the participants is a necessary preparatory step that should be undertaken by instructors. It is recommended that assistants be present to aid the participants with physical activities and that the instructor considers using digital means to bring the experience of nature to the participants. Similarly, if circumstances mandate virtual learning, it is recommended that instructors modify the lessons and activities as such. For example, if the lesson calls for sample collection, the instructor should modify the lesson to accommodate the various types of material collected by participants near their homes. An alternative to this may include mailing pre-packaged kits to the participants or organizing a pick-up of kits at a local library branch. Although this curriculum attempts to disengage participants with electronic entertainment, it may be necessary to embrace the accessible nature of technology.

The dissemination of this curriculum can be accomplished through several avenues. Integration of the curriculum into the public-school system would be straightforward, as many of the learning objectives incorporated in The Nature of Us align with education standards. It would, however, be necessary to modify the assessments to satisfy AYP requirements set forth by education mandates. Similarly, university extension agencies played an integral part in the development of the curriculum and it is recommended that it be distributed to local extension agents. These individuals would be able to provide the curriculum to inquiring instructors and program leaders that are seeking new instructional material. Furthermore, arboretums and botanical gardens often host educational programs and events that would provide an effective platform for the curriculum. Finally, this curriculum will be distributed to the professionals that

participated in the evaluation process as a courtesy and the hope that these individuals will use The Nature of Us in their own instruction.

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Appendix A

The Nature of Us
A curriculum that draws parallels between horticulture and wellbeing

Planning Unit
Lesson 1 - Green Space

Introduction:

Green space is defined as any land that is partially or wholly covered in vegetation and accessible to the public. It provides food, materials, recreation, education, and sustains natural plant and animal life that is essential to the ecosystem. Green spaces are shrinking, however, as the global population continues to rise. The percentage of urban residents is expected to rise to 68% by 2050, leaving the majority of humans reliant on city planning to provide green space, a human right as declared by the World Conservation Congress (2012).

Another challenge faced by green space is the rising use of electronic entertainment. Advances in technology have led young people to increasingly choose indoor recreation over nature. The shift from outdoor leisure activities to electronic entertainment has been suggested by researchers to have negative consequences on physical, psychological, and emotional health (Kimbell et al., 2009). The effect of decreased exposure to green spaces and increased urbanization, use of electric entertainment, and stresses from school and work on young people was defined by Richard Louv as “nature-deficit disorder” (NDD) (Warber et al., 2015).

The preservation and development of green space is essential to the health of our society. Not only does green space increase happiness as compared to urban environments, but it also facilitates physical activity, increased attentional capacity, the ability to reflect on life, and social cohesion, which acts as an intervention to negative health habits such as smoking and alcohol consumption, and negative health issues such as cognitive decline, stroke, and obesity.

This lesson will provide participants with a definition of green spaces, the opportunity to analyze how green spaces are used and designed, and the basic tools necessary for landscape design. In the first activity, participants will assess purpose and value of various types of green spaces. The participants will use the knowledge gained from this activity to develop their own garden designs in the second activity.

Time Frame:

Activity 1: 60 minutes

Activity 2: 60 minutes

Learning Objectives:*Horticultural & Biopsychosocial*

4. To define green space and discuss the various types and purposes of green space.
5. To define and apply the basic elements and principles of landscape design to green space design.
6. To analyze the purposes of and emotions evoked by green spaces.

Vocabulary:

- Green space: Any land that is partially or wholly covered in vegetation and is accessible to the public
 - o National parks
 - o Botanical gardens
 - o Therapeutic gardens
 - o Farm & Community-supported agriculture (CSA)
 - o Green roof
 - o Community park
- Nature-Deficit Disorder: A nonclinical term that describes the potential impact of decreased interaction with the natural world on human health

- Basic Elements of Landscape Design: Line, form, texture, and color
- Basic Principles of Landscape Design: Proportion, order, repetition, and unity

Methodology:**Activity 1:**

1. Begin a conversation about what participants do for leisure and fun. If the participants do not mention going outdoors, ask them if they used to play outside as young children or if their parents spent time outdoors.
2. Discuss the increasing use of electronics in daily life, both as necessity with work and school and for entertainment.
3. Ask the participants if they know that being removed from nature can have negative consequences on health. Define nature-deficit disorder and discuss results of research on the effects of green space on physical health, mental health, and social health.
4. Ask the participants what the term green space means to them. Define green space and discuss the need for conservation, preservation, and maintenance.
5. Display pictures of each type of green space defined above and ask the participants to answer the following questions for each picture in their notebooks:
 - a. Who would this green space serve?
 - b. What benefit would be provided by this green space?
 - c. What physical, emotional, and social benefits would be gained from this space?
6. Ask the participants to form pairs or small groups and share some of their answers for each type of green space. The pairs or small groups will discuss the value of each green space as it relates to the three questions above and then share with the collective group.
7. Show before & after pictures of urban green space and discuss local spaces that could be improved.

Activity 2:

1. Display several pictures of gardens and ask the participants to think about what aspects of the gardens are appealing.
2. Define the basic elements and principles of landscape design.
3. Assign participants to groups of 2-3 based on preferences for garden type. Multiple groups can have the same preference for garden type. Individuals in a group will work together to design a garden using grid paper and a circle template ruler, or coins and plastic cups.
4. Once completed, groups will display their designs.
5. Participants will individually assess the three questions from *Activity 1* for each group's design in a gallery walk. Participants are encouraged to write something positive or constructive criticism about each design on a sticky note.
6. After assessing each group, lead a closing discussion on the basic elements and principles of design found outside of green spaces, such as art, clothing, the exterior and interior of buildings and homes, etc. Instruct the participants to write a reflection as homework on the use of the elements and principles of design in their own residence.

Materials:

- Notebook
- Pictures of each type of green space
- Poster boards
- Tape OR push pins
- Grid paper

- Ruler with different size circles OR assortment of change: quarters, nickels, dimes & pennies (use for above-view design)

Measurement of Success/Assessments:

- Participants will submit their notebooks
- Participants will submit individual image boards and group designs
- Peer assessments using three questions for group designs
- Collect feedback on the activity and suggestions for improvements

Extensions:*Activity 1:*

1. If possible, take participants to a garden (botanical would be preferred) and have the group discuss the three questions as they relate to that garden
 - a. What benefit does THIS green space provide?
 - b. Who does THIS green space serve?
 - c. How does THIS green space make you feel?

Additional Resources:

- EPA. (n.d.). *What is open space/green space?* <https://www3.epa.gov/region1/eco/uep/openspace.html>
- Farag, A.A. (2016). *Urban spaces: Definitions and components* [PowerPoint slides]. SlideShare.
<https://www.slideshare.net/alshimaak/urban-spaces-69485308>
- Hansen, G. (n.d.). *Basic Principles of Landscape Design*. University of Florida Extension.
<http://edis.ifas.ufl.edu/pdffiles/MG/MG08600.pdf>
- Jiler, J. (2006). *Doing Time in the Garden*. New Village Press, Oakland, CA.
- Rupprecht, C.D.D. (2017). Informal urban green space: Residents' perception, use, and management preferences across four major Japanese shrinking cities. *Land*, 6(3), 59. <https://doi.org/10.3390/land6030059>
- Warber, S.L., DeHudy, A.A., Bailko, M.F., Marselle, M.R. and Irvine, K.N. (2015). Addressing "Nature-Deficit Disorder": A mixed methods pilot study of young adults attending a wilderness camp. *Evidence-Based Complementary and Alternative Medicine*. DOI: 10.1155/2015/651827
- World Conservation Congress. (2012). *Motions: Child's right to connect with nature and to a healthy environment* (Report No. WCC-2012-9.6).
https://www.iucn.org/sites/dev/files/import/downloads/2012_congress__all_motions_en.pdf

Preparation Unit
Lesson 1 - Soil

Introduction:

A small percentage of the earth's outer layer can be utilized by plants and animals as a foundation for life. Soil is composed of minerals, decaying plant and animal matter, water, and air, and is layered in a way that is specific to each ecosystem and site. This variance is what gives uniqueness to the plant and animal life found as different soils' abilities to hold water and minerals provides nutrients for different plants and other organisms. Furthermore, soil protects life as the minerals and microorganisms filter, break down, detoxify pollutants that occur as by-products of industrialization. As a horticulturalist, it is imperative to understand soil composition and structure to provide the appropriate environment for plant growth. Soil samples are an excellent method of examining these characteristics, and often include observations of color, smell, feel, and the presence of organisms living in the soil.

Soil can be considered as a bodyguard, provider of sustenance, and source of stability for all life. This foundation is essential for growth and development, just as a solid foundation is necessary for people to grow and develop to their full potential. Alfred Maslow believed that one's most basic physiological needs must be met before attaining feelings of safety, love, self-esteem, and self-actualization. In this lesson, participants will practice soil sampling and record observations of test sites and the soil samples, and learn about soil composition and structure. They will practice critical thinking by using the observations to make inferences as to what type of soil is present prior to completing the experiments. The participants will work together to develop a short presentation based on their individual and group findings, and reflect on the importance of a strong foundation for human growth and development.

Time Frame:

Activity 1a: 60 minutes

Activity 1b: 60 minutes

Activity 1c: 60 minutes

Activity 2: 45-60 minutes

Learning Objectives:*Horticultural & Biopsychosocial*

1. To collect and examine soil samples using the scientific method to make predictions about the samples.
2. To observe soil composition and structure.
3. To explore the value of strong foundations.

Vocabulary:

- Soil composition: Varying amounts of minerals, decaying plant and animal matter, water, and air
- Soil structure: The texture that results from the assembly of soil particles
- Soil particles: Clay, silt, sand, and gravel
- Maslow's Hierarchy of Needs
 - o Physiological needs: Food, water, warmth, rest
 - o Safety needs: Security
 - o Love and belonging: Intimate relationships, friends
 - o Esteem: Feeling accomplished
 - o Self-actualization: Achieving one's full potential, including creative activities

Methodology:

1. Prepare 4-6 flag stakes and 8-12 mason jars by using a sharpie to label each flag with one letter (A-F) that corresponds to a pair of mason jars labeled on the underside of the lids with the same letter (A-F).
2. Select 4-6 sites with varying soil types that are within a short walking distance of the meeting location and mark each site with a flag stake.

Activity 1a:

1. Begin a discussion about what the participants know about soil and what they think soil does. Allow the participants to make suggestions and then discuss the five essential functions of soil: regulate water, sustain life, filter pollutants, cycle nutrients, and physical stability.
2. Define soil composition and display or hand out the soil composition pie chart. Encourage participants to consider different biomes and make inferences about the soil compositions. Discuss fluctuations in the percentages as they relate to different ecosystems.
3. Explain that the participants will be conducting an experiment to examine different types of soil.
4. Divide the participants into 4-6 groups and give each group two mason jars and hand trowel. Assign a letter to each group (A-F).
5. Walk the groups to the sites marked with flag stakes. Instruct the participants to record their individual observations of their assigned group site, noting the presence of vegetation, animal life, and water, and to speculate on the soil composition.

Have groups:

6. Choose one area from which to collect two soil samples.
7. Using the hand trowels, remove any vegetation or debris to expose the surface of the soil.
8. Use the hand trowels to collect loose soil samples in the two mason jars. Fill one jar completely and fill one jar to the 4-oz mark by collecting soil 6" down from the surface.
9. Use the jewelry loupe to observe living organisms in the soil.
10. Discuss among themselves their individual observations and to develop a unified group theory of the soil composition and structure.

When finished, collect the 8-oz samples, and return to the classroom or normal meeting location for Activity 1b:

1. Have each group dump out the full mason jar sample onto a pan.
2. One sample at a time, allow all participants to physically examine the soil, noting the color, smell, texture, and presence of living organisms.
3. The group that collected the sample will then present their site observations and speculations on the soil composition before the participants examine the next sample.
4. Continue this pattern until each sample has been examined and each group has presented their findings.

Activity 1c:

1. Have the participants gather around and distribute the Suspended Soil Sample Worksheets to the participants. Each participant should receive a 4-6 worksheets. Explain that the participants will be recording the amount of water it takes to fill the jar to the 16-oz mark and the amount of time it takes for the sample to settle after shaking.
2. Using the measuring cup and counting the measurements out loud, fill the 4-oz samples with water to the 16-oz mark, seal, and shake well. Begin the stopwatches or timers after each sample has been shaken.

3. As the samples are settling and the stopwatch is counting, define and discuss soil particles with the participants and explain that larger particles will settle first, while smaller particles will remain suspended longer.
4. Have participants visually examine the suspended soil samples and complete a Suspended Soil Samples worksheet for each sample.
5. Reveal the which samples belong to which site after participants have completed the Suspended Soil Samples worksheets.
6. Discuss how the suspended soil samples correlate to the site observations and physical sample examinations.
7. Define soil structure and ask participants what type of soil structure would provide a good foundation for plants. Guide the discussion towards root growth and strength, and if plants would require additional physical or nutritional support.
8. Complete the lesson by leading a discussion on what the participants know about soil after completing the two activities.

Activity 2:

1. Review the five essential functions of soil, emphasizing the importance of soil as a foundation for life.
2. Ask participants if they think a strong foundation is important for human growth and development.
3. Instruct the participants to reflect in their notebooks on a time that they felt physically, emotionally, or socially out of control. The participants should be as detailed as possible in terms of what major events preceded the loss of control, what kind of diet was normal at the time, amount of sleep preceding the event, who was involved, and how the participants felt throughout the moment.
4. Introduce Alfred Maslow with a brief biography and explanation of his beliefs.
5. Display or distribute the Maslow's Hierarchy of Needs handout and discuss each level: physiological, safety, social, esteem, and self-actualization.
6. Have the participants re-read their reflection on a time they felt out of control and make notes regarding which, if any, levels of Maslow's Hierarchy of Needs were not being met, and why that information may be helpful in preventing that loss of control in the future.

Materials:

- Notebooks
- Sharpie or marker
- Measuring cup
- 4-6 stopwatches or timers
- 8-12 mason jars 16-ounce
- 4-6 flag stakes
- 4-6 hand trowels
- 4-6 jeweler's loupes
- 4-6 pans or tabletops that can be covered in soil samples
- Soil Composition Pie Chart handout
- Suspended Soil Samples worksheet
- Maslow's Hierarchy of Needs handout

Measurement of Success/Assessments:

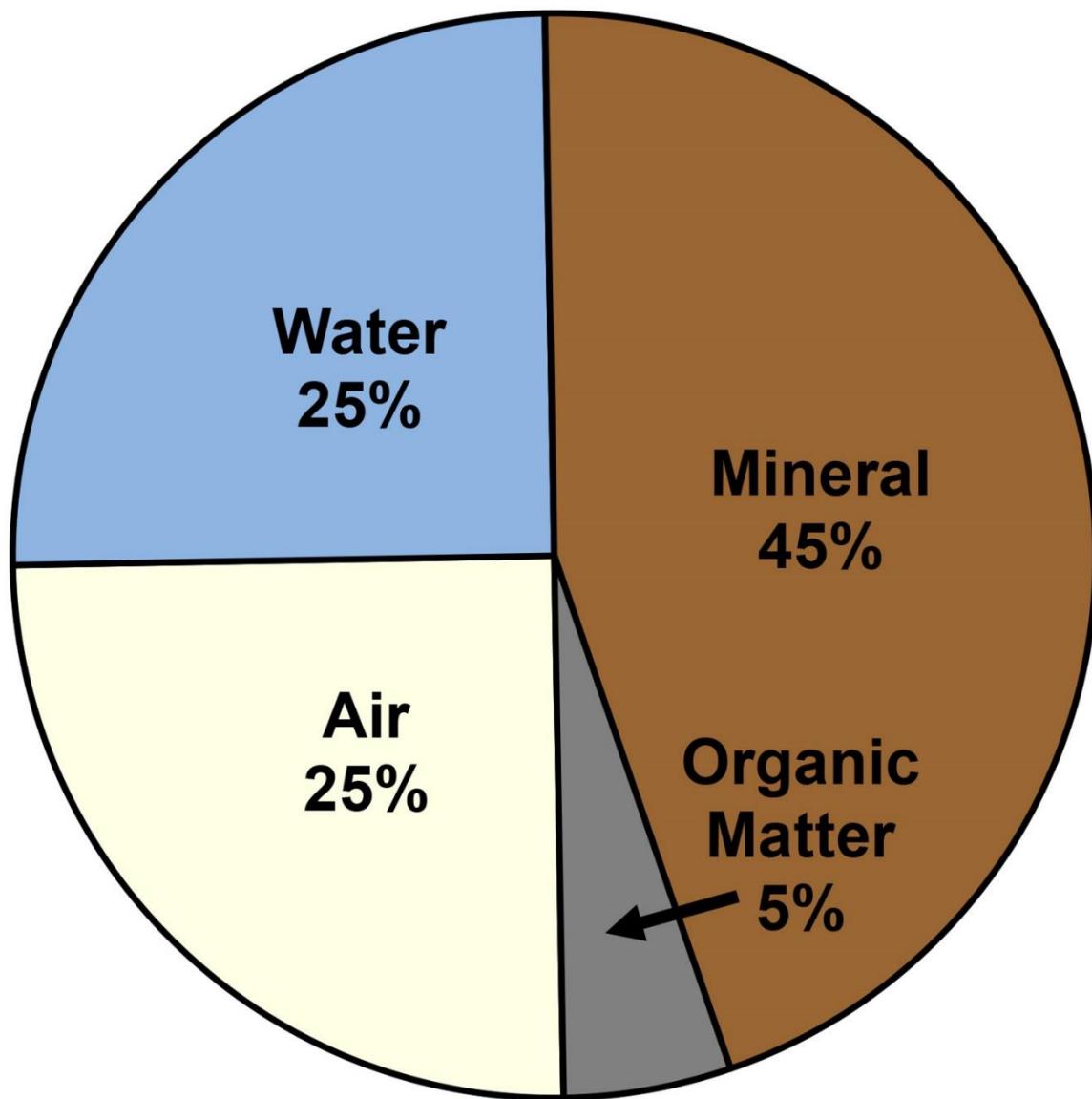
- Participation in the discussions and notebook reflections

- Cooperation and participation in group to collect samples and to present findings
- Completion of notebook observations, drawings, and predictions
- Submission of notebook
- Collect feedback on the activity and suggestions for improvements

Additional Resources:

- Cannizzo, J. (2010a). Growing with the garden: A curriculum for practicing horticulture with at-risk youth. *The Horticultural Society of New York*. Retrieved from <https://www.thehort.org/programs/greenhouse/>
- McLeod, S. (2020). *Maslow's hierarchy of needs*. SimplyPsychology. <https://www.simplypsychology.org/maslow.html#:~:text=Maslow's%20hierarchy%20of%20needs%20is,hierarchica,1%20levels%20within%20a%20pyramid.&text=From%20the%20bottom%20of%20the,esteem%2C%20and%20self%2Dactualization.>
- Natural Resource Conservation Service. (n.d.a). *Particle size demonstration*. United States Department of Agriculture. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054300
- Natural Resource Conservation Service. (n.d.b). *Soils 101*. United States Department of Agriculture. <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/7thru12/?cid=nrcseprd885606>
- Natural Resource Conservation Service. (n.d.c). *Soil Health*. United States Department of Agriculture. <https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>

Soil Composition

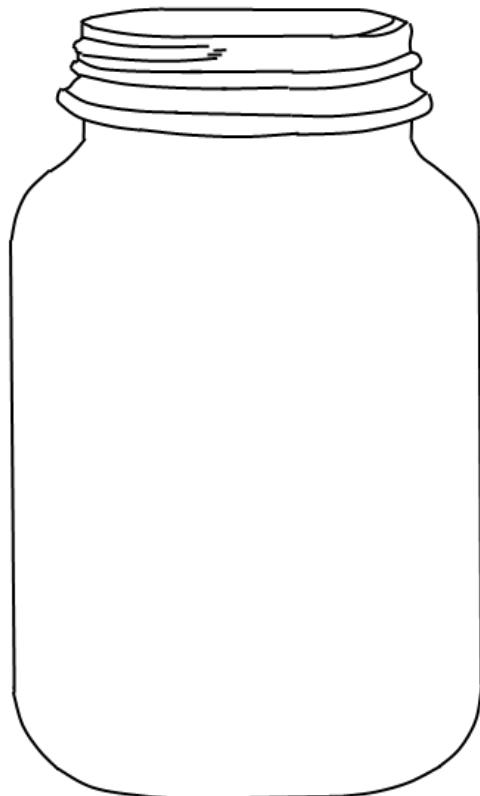


Suspended Soil Samples

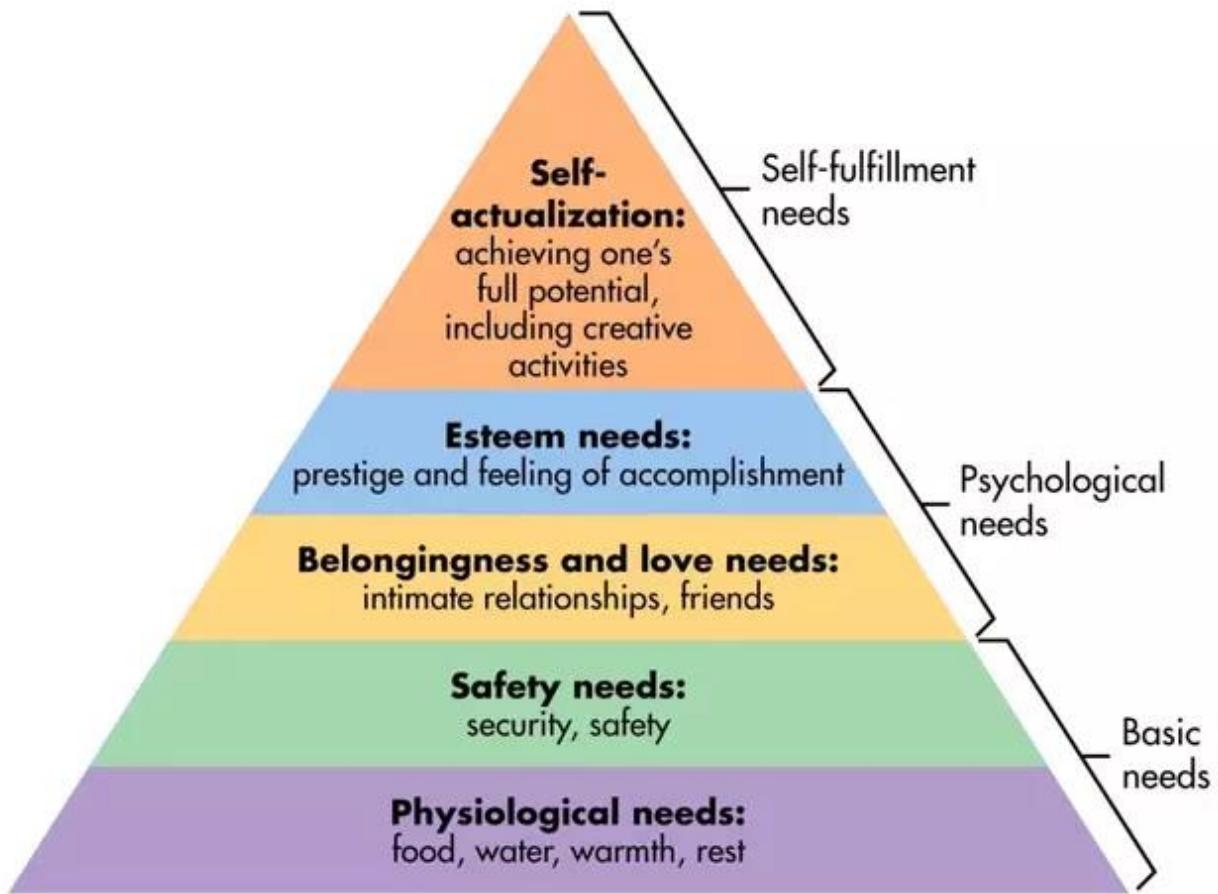
Directions

1. How much water was added to the sample? _____
2. How long did it take for the sample to settle? _____
3. Estimate the percentage of minerals, organic matter, water, and air are in the sample.
_____ % Minerals _____ % Organic Matter _____ % Water _____ % Air
4. Describe the soil particles found in the sample.

5. Draw the sample.
6. Which site does this sample belong to? _____



Maslow's Hierarchy of Needs



Preparation Unit
Lesson 2 - Anatomy

Introduction:

Structure can be found in almost every aspect of life, such as biological levels of organisms, social groups, psychology, government, and more. From the smallest unit of matter to the largest collection of organisms, we can define and organize the world in a way that allows us to understand our world and facilitate change. As horticulturalists, it is important to understand the structure of biological organisms and ecosystems, and to appreciate the connectivity that exists between all aspects of life.

As we come to understand that everything in life is connected, we must also understand that change should be a systemic and comprehensive effort that requires consideration and cooperation between every level. If we get sick, we cannot simply treat the symptoms without treating the underlying cause. Similarly, we cannot expect to make a desired change in our society without making a change to individual groups and communities. In this lesson, the participants will explore the importance of structure in biology and anatomy. The participants will also work in groups to dissect and identify plant anatomy, and to compare major plant and human anatomical function.

Time Frame:

Activity 1: 45-60 minutes

Activity 2: 60 minutes

Learning Objectives:*Horticultural & Biopsychosocial*

3. To explore levels of organization of biology and needs.
4. To compare the major anatomical functions of plant and human systems.

Vocabulary:

- Biological Levels of Organization
 - Atom: Smallest unit of matter
 - Molecule: Formed by at least two atoms held together by chemical bonds
 - Macromolecule: Large molecules typically formed by polymerization
 - Organelle: Small structure that exists within a cell
 - Cell: Smallest unit of structure and function in living organisms
 - Tissue: Group of similar cells carrying out similar or related functions
 - Organ: Collection of tissues grouped together performing a common function
 - Organ System: Group of functionally related organs
 - Population: All individuals of a species living within a specific area
 - Community: The sum of populations living within a specific area
 - Ecosystem: The sum of all living communities and non-living parts of that environment
 - Biosphere: The sum of all ecosystems

Methodology:*Activity 1:*

1. Ask the participants what comes to mind when they think of the word ‘structure.’ Lead a discussion on the importance of structure in terms of biological organization.
2. Distribute the Biological Levels of Organization worksheet to each participant to complete.

3. Define each item on the Biological Levels of Organization worksheet and allow participants to make corrections.
4. Lead a discussion on which, if any, levels of organization could be left out without significant impacts, and why levels can or cannot be left out.
5. Direct the discussion towards the importance of understanding structure in terms of maintaining or correcting the health of an organism.
6. Instruct the participants to think about a time that they were sick, the symptoms that they exhibited, and the treatment received. Ask them to consider what would have happened if the symptoms had been treated as individual problems rather than a systemic issue. For example, if a participant had strep throat, exhibited a fever, and only used a cold towel or anti-inflammatory medication, then the infection would have likely persisted causing additional problems.
7. End the discussion with an emphasis on the connectivity that exists between all levels of organization. Note that changes to one level will affect other levels. Instruct the participants to think about this connectivity as they go about their daily activities outside of the program.

Activity 2:

1. Prepare for the class by collecting fresh Hemerocallis plants that each participant will dissect.
2. Distribute the flowers, scissors, magnifying glass, glue, and paper to each participant.
3. As a collective group, identify and dissect each major part of the plant, discussing its function.
4. Instruct participants to divide into four groups based on four major anatomical functions: respiration, nutrient uptake, nutrient movement, and reproduction.
5. Each small group will use the dissected parts relating to its assigned anatomical function to be used for the collective diagram and prepare a short presentation on the major function of the plant and how it correlates to human anatomical function.
6. Each small group will glue its selected parts to create collective plant and human diagrams and present to the collective group.
7. Discuss the similarities between plant and human anatomy in relation to the four major functions used in the activity, noting the symbiotic relationship that plants and humans share.

Materials:

- Notebook
- Biological Levels of Organization handout
- Hemerocallis daylily flowers
- Scissors
- Magnifying glasses
- Glue
- Construction paper
- Human Outline

Measurement of Success/Assessments:

- Participation in the discussions and notebook reflections
- Completion of the Biological Levels of Organization worksheet
- Participation in group anatomy diagram activity and group presentations
- Submission of notebook

- Collect feedback on the activity and suggestions for improvements

Additional Resources:

- Cannizzo, J. (2010a). Growing with the garden: A curriculum for practicing horticulture with at-risk youth. *The Horticultural Society of New York*. Retrieved from <https://www.thehort.org/programs/greenhouse/>
- General Microbiology at Boundless. (2019a). *Properties of life*. Biology LibreTexts.
[https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_\(Boundless\)/1%3A_The_Study_of_Life/1.2%3A_Themes_and_Concepts_of_Biology/1.2A%3A_Properties_of_Life](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/1%3A_The_Study_of_Life/1.2%3A_Themes_and_Concepts_of_Biology/1.2A%3A_Properties_of_Life)
- General Microbiology at Boundless. (2019b). *Levels of organization of living things*. Biology LibreTexts.
[https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_\(Boundless\)/1%3A_The_Study_of_Life/1.2%3A_Themes_and_Concepts_of_Biology/1.2B%3A_Levels_of_Organization_of_Living_Things#:~:text=The%20biological%20levels%20of%20organization%20of%20living%20things%20arranged%20from,communities%2C%20ecosystem%2C%20and%20biosphere](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/1%3A_The_Study_of_Life/1.2%3A_Themes_and_Concepts_of_Biology/1.2B%3A_Levels_of_Organization_of_Living_Things#:~:text=The%20biological%20levels%20of%20organization%20of%20living%20things%20arranged%20from,communities%2C%20ecosystem%2C%20and%20biosphere)
- Yearout, N. (2019). *What are the levels of organization in biology?* Sciencing. <https://sciencing.com/levels-organization-biology-8480388.html>

Biological Levels of Organization

Directions

Order the following from smallest to largest, 1 being the smallest and 12 being the largest.

Biosphere

Organ System

Tissue

Atom

Population

Molecule

Community

Organelle

Cell

Organ

Macromolecule

Ecosystem

***** Instructor Key:**

12, 8, 6, 1, 9, 2, 10, 4, 5, 7, 3, 11

Preparation Unit

Lesson 3 - Seeds

Introduction:

With all the nutrient, soil, and irrigation enhancements available to horticulturalists, it is easy to forget that plants already contain the essentials for growth in the seed stage. Small in comparison to the mature plants that give rise to seeds, seeds can successfully germinate in the most unlikely places, such as sidewalk cracks or rocky hillsides. The ease with which seeds can germinate make them an ideal experiment for practicing horticulturalists. They provide a means for learning about plant growth and development, as well as subjects for further experimentation and observation in later units.

Determination goes a long way in nature and seeds are not the only organisms to display such characteristics. Viktor Frankl was a prominent psychologist who survived concentration camps during the second World War. In contrast to Maslow's Hierarchy of Needs, which puts basic physiological needs first, Frankl believed that a positive attitude despite suffering can lead to success and happiness. In this lesson, participants will explore the anatomy of seeds and the germination process through experimentation and observation. The participants will also consider the limited needs of seeds to germinate and compare the theories of Maslow and Frankl regarding human needs.

Time Frame:

Activity 1a: 15-30 minutes

Activity 1b: 30 minutes

Activity 1c: 10 minutes per day for 14 days

Activity 2: 30 minutes

Learning Objectives:*Horticultural & Biopsychosocial*

4. To identify and define parts of a seed.
5. To understand and practice seed germination.
6. To compare Maslow's Hierarchy of Needs and Frankl's Logotherapy.

Vocabulary:

- Seed: An immature plant in an arrested state
- Cotyledon: First leaf (leaves) to emerge
- Hypocotyl: Embryonic stem
- Radicle: Embryonic root
- Testa: Seed coat
- Germination: The process by which a seed resumes growth into a seedling, usually after a period of dormancy

Methodology:*Activity 1a:*

1. Ask the participants to define a seed. Allow the participants to make any suggestions that come to mind and then guide the discussion towards the definition that a seed is an immature plant in an arrested state.
2. Define the major parts of seeds and discuss their functions.
3. Ask the participants to list what seeds need to germinate and to consider plants growing in odd places (between cracks of sidewalks, on rocky sides of highways, etc.). Write down suggestions on a board for the group to see.

Activity 1b:

4. Distribute to each participant 1 half dozen egg carton, 1 plastic sandwich bag, 1 damp paper towel, 10 seeds, and enough soil to fill the egg carton.

Have participants:

5. Fold the damp paper towel into the shape of the sandwich bag and place inside.
6. Place 4 seeds on the damp paper towel and seal the bag.
7. Write name on the bag in marker and place bag in a warm, dark area.
8. Fill the half dozen egg carton with enough soil to fill each compartment.
9. Use a pencil, pen, or nail as a dibble to create a small hole corresponding in size to the seed into the soil.
10. Place the seed into the hole and cover with soil.
11. Use a sprinkler head watering can or hose to moisten the soil without saturating it.
12. Write name on the carton in marker and place in windowsill or under light source.

Activity 1c:

13. Participants will create an observation log in their notebooks and record daily observations on seed germination and emergence, and seedling growth and development. Observations should include length/height, color, smell, leaf changes, direction of growth, and a sketch.
14. At the end of the 14-day observation period, have participants create a final entry for this activity that lists what seeds need to germinate.

Activity 2:

8. Revisit the list of what seeds need to germinate. Ask the participants again what they think seeds need to germinate. Add any elements that are missing and cross off any unnecessary elements. Note how seeds have few needs for germination.
9. Introduce Viktor Frankl with a brief biography and explanation of his beliefs.
10. Compare Frankl's Logotherapy with Maslow's Hierarchy of Needs.
11. Have participants reflect in their notebooks on a time that they turned a bad situation or experience into something positive. The participants will also write a short paragraph answering the following questions:
 - a. Explain Frankl and Maslow's theories.
 - b. Is one theory more correct than the other?
 - c. Do you think that circumstance affected the development of each theory?
 - d. Do you agree with one theory more than the other?

Materials:

- Notebook
- Sharpie or marker
- For each participant:
 - o 1 half dozen cardboard egg carton
 - o 1 plastic sandwich bag
 - o 1 damp paper towel
 - o 10 tomato, cucumber, squash, or cantaloupe seeds
 - o Enough blended compost and topsoil to fill the egg carton
 - o Windowsill or light source

Measurement of Success/Assessments:

- Participation in the discussions and notebook reflections
- Participation in the seed germination activities

- Completion of the observation activity
- Submission of notebook
- Collect feedback on the activity and suggestions for improvements

Extensions:*Activity 1:**Have participants*

1. Prepare garden beds by removing undesired vegetation and adding soil.
2. Use a hand trowel or hands to create a small hole in the garden bed that is twice as wide as each seedling plug but only as deep.
3. Gently grasp the seedling in the egg carton and remove it from the carton.
4. If the roots are encircling the plug, gently ruffle the plug to loosen the roots.
5. Place the plug in the hole and fill in with excess soil, gently pressing down on the surrounding soil.
6. Stake plants if necessary and water.

Additional Resources:

About Viktor Frankl. (n.d.). Viktor Frankl Institute of Logotherapy.

http://logotherapyinstitute.org/About_Viktor_Frankl.html

Britannica. (n.d.). Germination. In *Britannica.com dictionary*. <https://www.britannica.com/science/germination>

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Cuncic, A. (2019). *An overview of Viktor Frankl's Logotherapy*. Verywellmind. <https://www.verywellmind.com/an-overview-of-victor-frankl-s-logotherapy-4159308>

Leubner, G. (2020). *Seed structure and anatomy*. The Seed and Biology Place.
<http://www.seedbiology.de/structure.asp>

McLeod, S. (2020). *Maslow's hierarchy of needs*. SimplyPsychology.

<https://www.simplypsychology.org/maslow.html#:~:text=Maslow's%20hierarchy%20of%20needs%20is,hierarchical%20levels%20within%20a%20pyramid.&text=From%20the%20bottom%20of%20the,esteem%20and%20self%2Dactualization>

Penn State Extension. (2012). *Seed and seedling biology*. <https://extension.psu.edu/seed-and-seedling-biology>

Welbaum, G. (2005). *Vegetable seed production*. <https://welbaum.spes.vt.edu/seedproduction/index.html>

Maintenance Unit

Lesson 1 - Weeds

Introduction:

In the garden, maintenance serves many purposes. These include reducing competition for nutrients and light, directing growth, and preventing damage, injury, or loss. Weeds are a time-consuming and often frustrating part of maintenance. These overly competitive plants can reduce light and airflow, take up available nutrients in the soil, spread pests and diseases, and spoil aesthetics. When herbicides, fabric barriers, and other mechanical methods of weed control are not available or desirable, the most effective method of weeding involves the complete removal of the weed by hand. It is important that the root system is also removed, as weeds are notorious for their determination. Weeds get a bad reputation due to this determination, but determination is a characteristic that should be admired.

When it comes to weeds, we all have different opinions of the definition but there is typically a negative connotation associated with it. The phrase ‘beauty is in the eye of the beholder’ is familiar to most, but particularly applicable when it comes to weeds. A common weed that is found across the globe is the dandelion. Dandelions are frustrating in lawns and gardens but they have an important purpose. Not only do they provide food for a variety of animal life, including honeybees and pollinators, they have been used to treat ailments for centuries. The flower, leaves, stem, and root of dandelion are used for their potential medicinal purposes, which include reducing inflammation and cholesterol, regulating blood sugar, boosting the immune system and reducing the risk of cancer, aiding digestion, and protecting skin from sun damage. When considering the benefits of dandelion, it becomes difficult to label it as a weed. Perspective is important when making assessments and decisions, whether in the garden or in life. In this lesson, participants will gain an understanding of weeds and their role in the garden, and experiment with different methods of weed removal. They will also explore the importance and impact of perspective.

Time Frame:

Activity 1a: 45-60 minutes

Activity 1b: 60 minutes

Activity 2: 60 minutes

Learning Objectives:

Horticultural & Biopsychosocial

3. To define weeds and demonstrate proper weeding technique.
4. To analyze the value of perspective.

Vocabulary:

- Weeds: Typically, an unwanted or invasive plant
- Pollinators: Any organism that helps carry pollen from the male part of the flower to the female part of the flower
- Perspective: Point of view

Methodology:

Activity 1a:

1. Have participants split into two groups. One group will use hand trowels to remove weeds from half of the garden beds. The other group will pull weeds by hand from the other half of the garden beds.
2. As the participants are weeding, start a discussion about what the participants think are weeds.

3. Describe the importance of weeds and wildflowers in terms of pollinators and medicinal properties.
4. Mark each garden bed according to how weeds were removed.

Activity 1b:

5. Read aloud Ralph Waldo Emerson's definition of a weed: "A plant whose virtues have never been discovered." Ask the participants to discuss their impression of his definition.
6. Begin a conversation about a current issue (Ex. returning to school during the Coronavirus pandemic) and pare down the discussion to two perspectives (Ex. teachers and parents).
7. Divide the participants into two groups and assign each group to a perspective.
8. Instruct the groups to develop an argument that supports their point of view and then present their stance to the other group.
9. Have the participants reflect in their notebooks on their opinion of the current issue after hearing the other group's perspective, and how the discussion on the definition of weeds relates to the activity.

Activity 2:

1. 3-7 days after *Activity 1*, examine the difference in weed reemergence between the two methods of weed removal.
2. Discuss the determination of plants to survive despite being cut and damaged.
3. Instruct the participants use hand trowels to remove weeds from the garden beds.
4. Have the participants reflect in their notebooks on a time in their lives that they had to be resilient and persevere despite being physically or mentally hurt.

Materials:

- Notebook
- Hand trowels
- Marker

Measurement of Success/Assessments:

- Participation in the discussions and notebook reflections
- Participation in the weeding activity
- Participation in the perspective activity
- Collect feedback on the activity and suggestions for improvements

Additional Resources:

- Fletcher, J. (2019). *10 health benefits of dandelion*. Medical News Today.
<https://www.medicalnewstoday.com/articles/324083#what-is-dandelion>
- Morgan, S. (2017). *A summer sampling of indoor therapeutic horticulture activities*. Horticulture Therapy Institute.
Retrieved from <https://htinstitute.org/community/summer-indoor-therapeutic-horticulture-activities/>
- Welbaum, Greg. (2015). *Vegetable Production and Practices*. CABI, Boston, Massachusetts.

Maintenance Unit

Lesson 2 - Pruning

Introduction:

Everything in life is constantly changing; our experiences, skills, knowledge, communities, planet, and the list goes on. Guiding change towards a desired direction or outcome requires careful attention, patience, and diligence. Mother nature is regarded as a force to be reckoned with and plants, pests, and diseases are no exception. Without pruning, plants can grow out of control, experience physical damage, and suffer from pests and diseases. These natural consequences are some of the most common reasons for pruning. However, pruning is not one-size-fits-all; different types of plants require different pruning techniques at different times of the growing season. Horticulturalists must consider many factors when creating a pruning regimen, including desired structure, health, and production.

People require the same careful attention when it comes to pruning. Learning new skills, developing or ending relationships, or working towards a goal are all examples of maintenance. Maintenance serves as an opportunity for checks and balance in our lives. It is important to develop a plan with specific strategies for achieving desired change. As in the garden, desired change in our lives requires careful attention, patience, and diligence. In the first activity, participants will learn about why, when, and how to prune common plants and trees. The participants will also engage in their own pruning practices by developing a plan to make desired changes in their lives.

Time Frame:

Activity 1: 45-60 minutes

Activity 2: 30 minutes

Learning Objectives:

Horticultural & Biopsychosocial

3. To define and explore proper pruning techniques.
4. To investigate goal setting and execution.

Vocabulary:

- Deciduous: A plant that loses its foliage each growing season
- Evergreen: A plant that retains its foliage through more than one growing season
- Heading back or thinning: Shortening individual stems
- Rejuvenation: Complete removal of stems to 4-6" from the ground
- Renewal: Selective removal of older stems over time
- Shearing: Reducing total leaf surface of a plant

Methodology:

Activity 1:

1. Ask the participants to suggest *why* plants should be pruned.
2. Explain the major reasons to prune while emphasizing generalized phrases that cross horticultural and BPS goals:
 - a. Promote plant health → Proactive focus on health
 - b. Control growth → Direct energy towards a specific goal
 - c. Improve flowering or fruit production → Conserve resources
 - d. Remove undesirable and dangerous plants → Create safe and healthy surroundings
3. Display pictures of various plants at different stages of growth and ask participants to make educated guesses as to *when* the plants should be pruned.

4. Discuss when pruning should take place for the following:
 - a. Deciduous trees & shrubs
 - b. Evergreen trees & shrubs
 - c. Vegetables and fruits
5. Define the basic pruning techniques:
 - a. Heading back or thinning
 - b. Rejuvenation
 - c. Renewal
 - d. Shearing
6. Distribute the Pruning 1 handout to participants to complete individually.

Activity 2:

1. Have participants reflect on the major reasons for pruning and how they relate to changing behaviors and influencing habits.
2. Distribute the Pruning 2 handout, scissors, tape or glue stick, and a sheet of colored construction paper to each participant.
3. Instruct the participants to write on each leaf something that makes them frustrated, sad, or that is preventing them from being happy.
4. Explain that the participants will use the scissors like pruning shears to cut away the unhealthy leaves, leaving a plant ready for regrowth.
5. Have participants write 2-3 resolutions or goals that relate to their own biopsychosocial health on the colored construction paper, cut out each goal in the shape of the leaf, and attach the new leaves to the plant.
6. Ask the participants to name some of their goals and discuss how each goal relates to either physical, psychological, or social categories.
7. Direct the conversation towards specific actions that lead to achieving the resolutions or goals.
8. Distribute the Pruning 3 handout to participants to complete as homework.

Materials:

- Notebook
- Pruning 1, Pruning 2, and Pruning 3 handouts
- Scissors
- Colored construction paper
- Tape or glue sticks

Measurement of Success/Assessments:

- Participation in the discussions
- Completion of Pruning 1, Pruning 2, and Pruning 3 handouts
- Collect feedback on the activity and suggestions for improvements

Additional Resources:

Pruning landscape plants. (n.d.) New Mexico Agricultural Education and FFA Association.

http://www.nmfaf.org/uploads/4/1/0/7/41075673/c4_3_pruning_landscape_plants.pdf

Pruning deciduous shrubs. (n.d.). The Morton Arboretum. <https://www.mortonarb.org/trees-plants/tree-and-plant-advice/horticulture-care/pruning-deciduous-shrubs>

Pruning 1 Handout

Directions

1. Match each picture with the correct reason for pruning.
2. Provide two techniques that could be used for each picture.

**Reasons for Pruning**

- A. Health
- B. Growth
- C. Production
- D. Danger



Pruning 2 Handout

Directions

1. Write things that make you frustrated, sad, or prevent you from being happy on the leaves.
2. Use your ‘pruning shears’ to remove the unhealthy leaves.
3. Write 2-3 resolutions or goals on the colored construction paper, cut out each goal in the shape of a leaf, and attach the new leaf to the plant.



Pruning 3 Handout

Directions

1. List 3 resolutions or goals that would benefit your physical, emotional, or social health.
2. List 2 things that you can do to achieve each resolution or goal.

Ex.) Finish my degree

- a. Avoid distractions & focus on my project
- b. Stay positive and engaged

1. _____

a. _____

b. _____

2. _____

a. _____

b. _____

3. _____

a. _____

b. _____

Nutrition Unit

Lesson 1 – Nutrition and Balance

Introduction:

The proper growth and development of a living organism is dependent on an intricate combination and balance of chemicals and conditions. Both plants and humans require nutrients and energy for all functions and processes involved in the completion of a life cycle. Mineral nutrients must meet three criteria to be considered essential: the organism cannot complete its lifecycle without the element, the element's function must not be replaceable by another element, and the element must be directly involved or required in metabolism (Marschner, 2012). Essential nutrients are categorized as macro and micronutrients, which denotes the concentration of the nutrient required for life.

The major difference between plants and humans is the method in which each obtains nutrients. Most plants are autotrophs, meaning they can synthesize atmospheric carbon dioxide through photosynthesis. Humans are heterotrophs and cannot make their own carbon and must take nutrients from other sources. These differences aside, plants and humans both rely on the complex interaction between essential nutrients for all functions of growth, development, and equilibrium.

In this lesson, the participants will be introduced to the essential nutrients required for life and explore the nutritional inequalities that exist among food sources. The participants will directly observe the effects of nutrient source on plant growth and development in the first activity and explore their own nutrition in the second activity.

Time Frame:

Activity 1a: 45-60 minutes

Activity 1b: 15 minutes per week for 4+ weeks

Activity 2: 60 minutes

Learning Objectives:*Horticultural & Biopsychosocial*

5. To define macro and micronutrients.
6. To explain the effects of the rhizosphere and microbiome on plant and human nutrition.
7. To explore the effect of the synthetic fertilizer as compared to organic fertilizer on plant growth and development.
8. To explore the effects of an unbalanced diet on human growth and development.

Vocabulary:

- Fertilizer
 - o Synthetic: Inorganic nutrients that are artificially synthesized and/or minerals mined from deposits
 - o Organic: Enriched organic matter, either plant or animal, in various stages of decomposition
- Autotroph: An organism that can form nutritional organic substances from simple inorganic substances such as carbon dioxide
- Heterotroph: An organism that must find and absorb nutrients from their environment
- Essential Nutrients: Nutrients that must be present in order for a plant to complete its lifecycle and cannot be replaced by another element
 - o Macronutrients: Elements required in large quantities
 - o Micronutrients: Elements required in small quantities
- Rhizosphere: The soil surrounding plant roots, which is influenced by root activity

- Microbiome: Consists of the microorganisms associated with all plant/human parts, of which have a wide and beneficial impact on fitness and productivity, and improve resistance to stresses
- Processed Food:
 - A. Any food that has been altered in some way during preparation. Ex. frozen or canned vegetables, baked breads, dried meats
 - B. A food that typically comes packaged and contains high levels of salt, sugar, and fat that are added to extend shelf life, or contribute to flavor or structure. Ex. breakfast cereals, chips, sodas

Methodology:

1. Prepare eight growing containers using clear plastic 2-liter bottles.
2. Cut the bottles in half, discard the tops and punch holes in the bottoms for drainage.

Activity 1a:

1. Divide the participants into four or eight groups.

Have groups:

2. Fill four of the containers with inert potting mix and fill the other four with blended soil. Plant eight rooted plugs in the containers.
3. Feed the plants in potting mix with a water-soluble synthetic fertilizer once every 7-14 days (synthetic condition), and those in the blended soil with the nutrients in the soil (organic condition). Water as needed.
4. Ask the participants what they expect to happen to the plants in the two conditions. Explain that the blended soil contains a broader range of nutrients than the water-soluble fertilizer
5. Define macro- and micronutrients and discuss the importance of water.
6. Ask the participants to speculate about the similarities and differences between nutritional requirements of plants & humans. Define and compare autotrophs and heterotrophs.
7. Introduce the terms rhizosphere and microbiome and compare in plants and humans.
8. Make inferences in notebooks about the effects of synthetic and organic fertilizer on plant growth and development.

Activity 1b:

As the plants grow, observe the similarities and differences in root, shoot and leaf growth between the groups

9. Have participants record weekly observations on the development of the plants that include size, leaf number, color, and root growth.
10. To conclude the observations, participants will make inferences in notebooks as to why the plants in each condition grow and appear different or the same, and how the participants' diet may affect their growth and development.

Activity 2:

1. Ask participants to record in their notebooks everything they eat and drink for three days, and note their most consumed snack food and beverage for the next group meeting.
2. At the next group meeting, ask the participants to define processed foods. Encourage discussion and differing opinions. Explain the two definitions of processed foods.
3. Compare the second definition of processed foods to synthetic fertilizers and make inferences about the nutritional value of the snacks/beverages and the effects they have on growth and development.

4. Using a computer or phones, open the USDA FoodData Central search engine to search and display the nutritional content of the participants' most consumed snack food. Make note of the present nutrients and additives.
5. Ask the participants to discuss anything about the nutritional values that was surprising or interesting.
6. Review the importance of water on health and development that was discussed in *Activity 1a* and how that relates to humans.
7. Remind the participants of the microbiome's role in health and make inferences about the relationship between an unbalanced diet on growth and development.
8. Distribute the USDA "Choose the Foods You Need to Grow" tip sheet to participants.
9. Have participants complete the USDA MyPlate Plan and discuss solutions for maintaining a balanced diet. This can be done during the program or at home.

Materials:

- Notebook
- 8 rooted seedlings from Preparation Unit Lesson 3 - Seeds
- 8 clear plastic 2-liter bottles cut in half with holes punched in the bottom for drainage
- Water can or container
- Blended compost and topsoil
- Inert potting mix
- 10-10-10 liquid soluble fertilizer
- USDA "Choose the Foods You Need to Grow" tip sheets
- Computers or cell phones for the USDA MyPlate Plan

Measurement of Success/Assessments:

- Participation in the discussions
- Completion of food log and MyPlate Plan
- Submission of notebooks
- Collect feedback on the activity and suggestions for improvements

Extensions:*Activity 1:*

1. Add mycorrhizae to two of the containers in the synthetic condition and to two of the containers in the organic condition.
2. Observe any differences within those groups.

Additional Resources:

Bikle, A. and Montgomery, D.R. (2016). Junk food is bad for plants, too: How a steady diet of fertilizers has turned crops into couch potatoes. *Nautilus*, 34. <http://nautil.us/issue/34/adaptation/junk-food-is-bad-for-plants-too>

Fuhrman, J. (2018). The hidden dangers of fast and processed food. *American Journal of Lifestyle Medicine*, 12(5), 375-381. DOI: 10.1177/1559827618766483

Marschner, Petra. 2012. Mineral nutrition of higher plants. 3rd ed. Academic Press, London, England.

McIntosh, J. (2018). *Fifteen benefits of drinking water*. Medical News Today.
<https://www.medicalnewstoday.com/articles/290814>

Messig, D. and Grob, J. (2018). Understanding plant nutrition – The genesis of students' conceptions and the implications for teaching photosynthesis. *Education Sciences*, 8(132). DOI: 10.3390/educsci8030132

Eating processed foods. (2020). National Health Service. <https://www.nhs.uk/live-well/eat-well/what-are-processed-foods/?tabname=digestive-health>

Singh, B., Trivedi, P., Singh, S., and MacDonald, C.A. (2018). Emerging microbiome technologies for sustainable increase in farm productivity and environmental security. *Microbiology Australia*, 17-23. DOI: 10.1071/MA18006

- United States Department of Agriculture. (2014a). *Choose the foods you need to grow: 10 tips for teen girls.* <https://choosemyplate-prod.azureedge.net/sites/default/files/tentips/DGTipsheet36EatSmartAndBeActiveAsYouGrow.pdf>
- United States Department of Agriculture. (2014b). *Choose the foods you need to grow: 10 tips for teen guys.* <https://choosemyplate-prod.azureedge.net/sites/default/files/tentips/DGTipsheet34ChooseTheFoodsYouNeedToGrow.pdf>
- United States Department of Agriculture. (n.d.). *FoodData Central.* <https://fdc.nal.usda.gov/>
- United States Department of Agriculture. (n.d.). *MyPlate Plan.* <https://www.choosemyplate.gov/resources/MyPlatePlan>
- Welbaum, Greg. (2015). Vegetable Production and Practices. CABI, Boston, Massachusetts.

Choose the Foods You Need to Grow Tip Sheet



10 tips

Nutrition
Education Series



eat smart and be active as you grow

10 healthy tips for teen girls



ChooseMyPlate.gov

Young girls, ages 10 to 19, have a lot of changes going on in their bodies. Building healthier habits will help you—now as a growing teen—and later in life. Growing up means you are in charge of foods you eat and the time you spend being physically active every day.

1 build strong bones

A good diet and regular physical activity can build strong bones throughout your life. Choose fat-free or low-fat milk, cheeses, and yogurt to get the vitamin D and calcium your growing bones need. Strengthen your bones three times a week doing activities such as running, gymnastics, and skating.



2 cut back on sweets

Cut back on sugary drinks. Many 12-ounce cans of soda have 10 teaspoons of sugar in them. Drink water when you are thirsty. Sipping water and cutting back on cakes, candies, and sweets helps to maintain a healthy weight.

3 power up with whole grain

Fuel your body with nutrient-packed whole-grain foods. Make sure that at least half your grain foods are whole grains such as brown rice, whole-wheat breads, and popcorn.



4 choose vegetables rich in color

Brighten your plate with vegetables that are red, orange, or dark green. Try acorn squash, cherry tomatoes, or sweet potatoes. Spinach and beans also provide vitamins like folate and minerals like potassium that are essential for healthy growth.



5 check Nutrition Facts labels for iron

Read Nutrition Facts labels to find foods containing iron. Most protein foods like meat, poultry, eggs, and beans have iron, and so do fortified breakfast cereals and breads.

6 be a healthy role model

Encourage your friends to practice healthier habits. Share what you do to work through challenges. Keep your computer and TV time to less than 2 hours a day (unless it's school work).

7 try something new

Keep healthy eating fun by picking out new foods you've never tried before like lentils, mango, quinoa, or kale.

8 make moving part of every event

Being active makes everyone feel good. Aim for 60 minutes of physical activity each day. Move your body often. Dancing, playing active games, walking to school with friends, swimming, and biking are only a few fun ways to be active. Also, try activities that target the muscles in your arms and legs.



9 include all food groups daily

Use MyPlate as your guide to include all food groups each day. Learn more at www.ChooseMyPlate.gov.

10 everyone has different needs

Get nutrition information based on your age, gender, height, weight, and physical activity level. Use SuperTracker to find your calorie level, choose the foods you need, and track progress toward your goals. Learn more at www.SuperTracker.usda.gov.

SuperTracker

Choose the Foods You Need to Grow Tip Sheet



10 tips
Nutrition
Education Series



choose the foods you need to grow

10 tips for teen guys



ChooseMyPlate.gov

Feed your growing body by making better food choices today as a teen and as you continue to grow into your twenties. Make time to be physically active every day to help you be fit and healthy as you grow.

1 get over the idea of magic foods

There are no magic foods to eat for good health. Teen guys need to eat foods such as vegetables, fruits, whole grains, protein foods, and fat-free or low-fat dairy foods. Choose protein foods like unsalted nuts, beans, lean meats, and fish. SuperTracker.usda.gov will show if you are getting the nutrients you need for growth.



2 always hungry?

Whole grains that provide fiber can give you a feeling of fullness and provide key nutrients. Choose half your grains as whole grains. Eat whole-wheat breads, pasta, and brown rice instead of white bread, rice, or other refined grains. Also, choose vegetables and fruits when you need to "fill-up."

3 keep water handy

Water is a better option than many other drink choices. Keep a water bottle in your backpack and at your desk to satisfy your thirst. Skip soda, fruit drinks, and energy and sports drinks. They are sugar-sweetened and have few nutrients.



4 make a list of favorite foods

Like green apples more than red apples? Ask your family food shopper to buy quick-to-eat foods for the fridge like mini-carrots, apples, oranges, low-fat cheese slices, or yogurt. And also try dried fruit; unsalted nuts; whole-grain breads, cereal, and crackers; and popcorn.

5 start cooking often

Get over being hungry by fixing your own snacks and meals. Learn to make vegetable omelets, bean quesadillas, or a batch of spaghetti. Prepare your own food so you can make healthier meals and snacks. Microwaving frozen pizzas doesn't count as home cooking.



6 skip foods that can add unwanted pounds

Cut back on calories by limiting fatty meats like ribs, bacon, and hot dogs. Some foods are just occasional treats like pizza, cakes, cookies, candies, and ice cream. Check out the calorie content of sugary drinks by reading the Nutrition Facts label. Many 12-ounce sodas contain 10 teaspoons of sugar.

7 learn how much food you need

Teen guys may need more food than most adults, teen girls, and little kids. Go to www.SuperTracker.usda.gov. It shows how much food you need based on your age, height, weight, and activity level. It also tracks progress towards fitness goals.



8 check Nutrition Facts labels

To grow, your body needs vitamins and minerals. Calcium and vitamin D are especially important for your growing bones. Read Nutrition Facts labels for calcium. Dairy foods provide the minerals your bones need to grow.

9 strengthen your muscles

Work on strengthening and aerobic activities. Work out at least 10 minutes at a time to see a better you. However, you need to get at least 60 minutes of physical activity every day.



10 fill your plate like MyPlate

Go to www.ChooseMyPlate.gov for more easy tips and science-based nutrition from the Dietary Guidelines for Americans (www.DietaryGuidelines.gov).

Harvest Unit

Lesson 1 – Challenging Preconceptions

Introduction:

We often make judgements about things based on what we have learned growing up or what we hear every day. For example, most people consider tomatoes and peppers to be vegetables. Botanically speaking, tomatoes and peppers are fruits, as they are the seed-bearing structure that develops from the ovary of a pollinated flower. Since these fruits are used as culinary vegetables, most people categorize them as vegetables.

It is important to recognize the similarities between this example and how prejudice and stereotypes affect our view of the world. Prejudice is defined as an unjustified attitude that has no basis in truth and stereotypes are oversimplified ideas that are often shared by members of a group about others. The agricultural and food and beverage (F&B) industries carry a number of stereotypes related to gender, culture, and ethnicity. Farming in the United States is typically regarded as a male dominated trade by advertising and music industries. Furthermore, farm laborers are often assumed to be migrant workers from Mexico and Central America. Similarly, a longstanding stereotype that is in the process of being challenged is that cooking is a woman's job even though men dominate the percentage of professional chefs in America.

Despite the facts, prejudice and stereotypes shape our perception of the world and its inhabitants. When we acknowledge that our beliefs and attitudes may be influenced by false or incomplete information, we can begin to build relationships with different groups and shape the future. This activity provides an opportunity for participants to become familiar with each other and to overcome challenges as a group despite individual differences. Participants will explore their own preconceived notions about what defines fruits and vegetables, and how stereotypes affect their perception of the agricultural and F&B industries in the first activity. In the second activity, the participants will challenge these perceptions by reflecting on this curriculum's effect on their satisfaction, self-esteem, and resilience.

Time Frame:

Activity 1a: 45-60 minutes

Activity 1b: 30-45 minutes

Activity 2: 60 minutes

Learning Objectives:*Horticultural & Biopsychosocial*

1. To differentiate between botanical and culinary definitions of fruits and vegetables.
2. To consider the roles that prejudice and stereotypes have in the agricultural and food and beverage industries.
3. To evaluate the program's activities as they pertain to participant satisfaction, self-esteem, and resilience.

Vocabulary:

- Fruit: A seed-bearing structure that develops from the ovary of a pollinated flower
- Vegetable: Roots, stems, and leaves of edible plants
- Prejudice: An unjustified attitude that is formed without knowledge or reason
- Stereotype: An oversimplified and standardized idea with special meaning and often held by members of a group

Methodology:

Activity 1a:

1. If the garden has produced, harvest fruits and vegetables as a group. Wash the produce and bring inside.
2. Without any introductory information, have participants place produce in either the “Fruit” category or “Vegetable” category. If no produce is harvested, make a list from participant suggestions or use cut-out pictures and place under one category or the other.
3. Ask the participants to justify their decisions.
4. Without any explanation, place the produce in the correct category and have the participants form pairs or small groups.
5. Have the pairs or small groups discuss why the changes were made and to develop a brief hypothesis that will be shared with the collective group.
6. After the pairs or small groups have presented their hypotheses, explain the difference between botanical and culinary definitions of fruits and vegetables.
7. Discuss with the participants why they believe that they were or were not correct in identifying the fruits and vegetables. Lead the discussion towards upbringing or cultural influences.

Activity 1b:

8. Ask participants to list types of jobs related to agriculture and the food and beverage (F&B) industry and to describe the people they envision in those roles. In this activity, it is important that the participants consider gender, race, and culture.
9. Discuss the existence of stereotypes in agriculture and the F&B industry.
10. Have participants reflect in their notebooks explaining what prejudice and stereotypes are and what impacts they have. Instruct the participants to use the metaphor between fruits and vegetables and to include an example in their reflections.
11. Instruct the participants to reflect in their notebooks on a time that they experienced prejudice firsthand, were prejudice against another, or witnessed prejudice.

Activity 2:

1. Have participants skim through activity reflections in their notebooks and discuss each part of the curriculum as a group.
2. Individually, have the participants submit a final reflection on the following questions:
 - a. Which activities did you enjoy the most? The least? (Satisfaction)
 - b. Which activities made you feel good about yourself? Bad about yourself? (Self-esteem)
 - c. Which activities challenged you the most? The least? (Resilience)
2. After reflections are submitted, lead a discussion on the questions above. Ask the participants which of the three questions is the most meaningful. Lead the discussion towards the conclusion that satisfaction, self-esteem, and resilience can supersede the power of stereotypes and prejudice.

Materials:

- Notebook
- Harvested produce OR pictures of produce
- Baskets OR table OR board and markers
- Other items & kitchen tools to create dish*

Measurement of Success/Assessments:

- Correctly categorizing produce as fruit or vegetable
- Participation in the discussion of race and gender issues in agriculture and the F&B industry

- Submission of notebook reflections on traditional gender roles and the course activities
- Collect feedback on the activity and suggestions for improvements

Extension activity: (This activity can occur at the beginning of *Activity 2*)

1. Discuss recipes that can be made with the harvested produce, vote, and make plans to create that dish at the next session (the dish can also be made at home and brought for the participants to enjoy).
2. If the garden did not produce and if possible, purchase items.

Additional Resources

Dictionary. (n.d.a). Prejudice. In *Dictionary.com dictionary*. <https://www.dictionary.com/browse/prejudice?s=t>

Dictionary. (n.d.b). Stereotype. In *Dictionary.com dictionary*. <https://www.dictionary.com/browse/stereotype>

Farmer or farmer's wife? Tackling gender stereotypes in agriculture. (2017). Food Processing Technology.

<https://www.foodprocessing-technology.com/features/featurefarmer-or-farmers-wife-tackling-gender-stereotypes-in-agriculture-5886019/>

Jahanestan, Y. (2019). *Fruits versus Vegetables*. Epersian Food. <https://www.epersianfood.com/fruits-versus-vegetables/>

Welbaum, G.E. Vegetable production and practices. Wallingford: CABI, 2015.

Appendix B

Expert Evaluation

Name:
Profession:

Unit:

Rate the following statements using the scale below.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Undecided
- 4 - Agree
- 5 - Strongly agree

The lesson is easy to follow.

Score

Total

0

The methodology is clear.

The lesson accomplishes the learning objectives.

The activity can be completed in the estimated time frame denoted.

The assessments provide adequate feedback on the lesson.

The additional resources support the learning objectives.

The activities are engaging.

The content is age appropriate.

The tools and materials are adequate.

The connection between plants and humans is tangible.

The lesson could easily be integrated into my existing program.

Answer the following questions.

What weaknesses exist?

What challenges do you foresee with this activity?

How could the lesson be improved?

Other comments:

Appendix C

Participant Evaluation

Name:

Activity:

Rate the following statements using the scale below.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Undecided
- 4 - Agree
- 5 - Strongly agree

This activity went well.

Total
0

This activity was easy to follow.

The concepts in this activity applied to me or people my age.

This activity made me consider new ideas or perspectives.

The connection between plants and humans was clear in this activity.

My friends and I enjoyed this activity.

Answer the following questions.

What were your favorite parts of the activity?

What were your least favorite parts of the activity?

How could this activity be better?

Would you recommend this activity to your friends?